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No. 6.—MODERN INSECTICIDES AND ECTOPARASITE CONTROL*

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Attendance was well maintained for the final paper of the Congress, this being discussed under the chairmanship of the President-elect, Mr. A. M. Graham, M.R.C.V.S., in the Royal Hall, Harrogate, on the Friday morning. The Recording Secretary was Mr. F. Lofthouse, M.R.C.V.S., of Otley.

The CHAIRMAN : As you know, we are going to discuss to-day a paper presented by that well-known team of research workers from the Cooper Technical Bureau at Berkhamsted, consisting of Mr. Downing, Mr. Harbour and Mr. Stones. These men are experts on this subject and they have world-wide experience of it. That is literally true because not only have they experience from experiments and work done in this country but they go all over the world.

I think this is a subject which should appeal to all of us, from the practitioners engaged both in small and large animal work to the whole-time men and I do hope we are going to have a very good discussion. Great strides have been made in this particular field in recent years.

I will now call on Mr. Harbour to say a few words about the paper by way of introduction. (Applause.)

Mr. H. E. HARBOUR : My colleagues and I should like first of all to express our appreciation to the Council for the privilege we have of presenting this paper to you here to-day.

We have tried to make the paper rather wide in scope to review the impact of the modern insecticides on the problems of insect and ectoparasite control. We have also put forward some of the snags and difficulties which have arisen during the development of this work.

In this country we are rather apt to think of external parasites as of comparatively little importance. Scab is very much on the decrease and we hope that if anyone talks about this subject next year he will be able to refer to scab in the past tense. But overseas you will find a very different attitude to the external parasite. We are aware, of course, that the tick is important in cattle in Scotland, Wales and Ireland, but if one compares the numbers of the parasites we see in those countries with what we see on a cattle beast in South Africa one gets a very different picture. In South and East Africa, when a research worker does his tick counts he very often uses a grapefruit knife to scrape them off in their thousands !

In Australia and South Africa, maggot fly comes in waves, and in Australia and New Zealand, where the merino sheep and other fine wool sheep are important even the ked is of great importance because of its damage to wool.

In this country the farmer does not like to see keds on his sheep but he does not regard them quite so seriously as our Australian colleagues do.

We have reviewed the effect of modern insecticides on insects and other parasites and I do not want to elaborate on all the concentrations which are applied and the insecticides which are effected. I just want to underline one or two of the snags.

When these modern insecticides were first introduced a cry of praise went up. Here at last were the non-poisonous insecticides ! That was true up to a point, but everything is poisonous if you give enough of it, and after a few years' experience we are beginning to realise the limitations from the point of view of toxicity of some of these modern insecticides.

DDT and BHC are very safe. But even BHC, which we have regarded as a particularly safe insecticide, produced its troubles this year in Queensland. We ran up against remarkable conditions where cattle were exposed to very long drought. They had little food and got very thin and they were concentrated together for the provision of additional feeding-stuffs. The tick found conditions very much to its liking, and ticks increased in numbers enormously. Cattle were dipped and sprayed, and in cases where concentrations went a little above what we regarded as necessary there was apparent BHC toxicity. However, the limits of these insecticides have been well worked out and except where there are extraordinary conditions of that kind they are very safe.

The way of the investigator into toxicity in the field is not always very easy. I recall the story of two of our colleagues who had been carrying out a trial with toxaphene against cattle tick in Mexico. It was in the early days of toxaphene. The formula with which they were working was rather unstable and a number of cattle died. The next morning my friends were breakfasting in the hotel when two very large Mexicans came in, each having three pistols in his belt. They were the owners of the dead cattle and they were demanding to see the scientists who had killed them ! However, it is not always quite as difficult as that.

Coming to resistance ; this is a far more serious problem and one which is occupying our attention very much. Arsenic-resistant ticks have been known for many years now in South Africa and have been suspected, at any rate, in many other parts of the world. BHC resistance has taken just about three years to emerge in South Africa and we are now seeing it in some other parts of the world. It has undoubtedly arisen in places where the insecticides have been regularly used in too low concentrations.

Quite apart from resistance, we have mentioned in our paper that there is another difficulty which has arisen, a phenomenon which we call " loss of biological efficiency." (In these days of abbreviations, we call it LOBE.) It occurs with BHC and DDT in cattle dipping baths where the cattle are dipped, perhaps, weekly. The baths get dirtier and dirtier and in the course of about three months the insecticide begins to lose its power of killing the ticks because it is actually destroyed, we think, by the bacteria which develop in the baths.

* Presented to the 70th Annual Meeting of the British Veterinary Association, at Harrogate, on September 12th, 1952.

Passing on to methods of application, dipping is undoubtedly the most efficient way of applying an insecticide to an animal's coat. I have a great respect for the simple hole in the ground which is filled with insecticidal wash and in which the animal is immersed. But dipping has always been unpopular with those who have to do it. It is laborious, especially sheep dipping, and is dirty and messy and not entirely without danger to the stock.

As a result, people all over the world have been trying to develop better methods of applying insecticides, and various methods of spraying have been adopted or tried out. To mention two of these, the first is the sheep shower and I refer to it particularly because I know from the contacts we have with veterinarians and agriculturalists in this country there is quite a lot of confusion in people's minds about this question of spraying.

We find that in applying DDT for maggot fly control we can get by ordinary spraying (with a bucket pump, for example) only about half the protection from our insecticide material that we get when we use the dipping method.

On the other hand, there are deluge sprayers, which originated in Australia, which subject the sheep to a deluge, at low pressure. The " tap is turned on " above the sheep and the nozzles which produce the spray are rotating or circulating, and there are also nozzles underneath the sheep which project up a spray under their bellies. Sheep can be penned in groups of 20 or so and subjected to this real deluge. There is a tremendous volume of insecticide wash at quite low pressure. The spray comes off the sheep, runs down gutters, and goes back into the sump where it is re-circulated by pumps.

That method does give substantially the same protection from maggot fly in this country as dipping. But anything short of that, such as the rapid galloping of sheep through a tunnel, with a light spraying, does not give anything like the same degree of protection.

The spraying of cattle is a very much more attractive proposition to some farmers than is dipping, and during recent years our colleagues in East Africa, and in South Africa, have been experimenting with mechanical races. Cattle are allowed to run through the race and are subjected to spray from nozzles set at various angles, above, on the side and below. These spray races are still very much experimental and it is not yet certain whether the degree of control obtained with them is as good as control by dipping. They are convenient and labour-saving but, after all, the most important thing is whether the apparatus will do the job.

The experimental spray race might possibly have an application in this country for the treatment of cattle for sarcoptic and chorioptic mange. Dipping baths for cattle are few in this country and it is possible to get a good control of sarcoptic mange in cattle by a very thorough spraying of the animals.

Just a word about the technique my colleagues have used for the testing of insecticides for the control of maggot fly. In conducting a field trial the usual procedure has been to dip half the sheep in the material you wish to test and to leave the other half as controls. The shepherd is given a notebook and he makes a list of all the strikes he gets during the following six weeks. Everybody agrees, I think, that that method is most unsatisfactory because it is generally found that the weather gets so dry and clear and bright that in fact you do not get any strike at all. You prove nothing.

A few years ago there was a remarkable paper, published by some veterinarians in this country, which, in summing up the results of field trials against the maggot fly, proved by statistics that DDT was " not better than nothing." Knowing that it was better than nothing, we were never quite sure whether that paper proved that statistics were not better than nothing, or that field trials were not better than nothing. At any rate, we did feel quite certain that the only satisfactory way of testing insecticides against blow fly was by deliberately producing fly blow and strike on sheep which had been treated, and the method (originally used in Australia) which we have used for the last few years, consists simply of breeding the flies (which in our case are *Lucilia sericata*), putting them in a light, warm, chamber in very large numbers and exposing sheep to their attack. By putting an attractant on the backs of the sheep we make quite certain we localise the place where the maggot fly lays the eggs. The sheep may be treated with certain materials and they are exposed to fly attack for a short period each week. For the rest of the week they stay on pasture exposed to the weather.

In that way a number of preparations can be tested at once and one can get a true appraisal of the real value of different concentrations and different insecticides in quite a short time.

To sum up, the modern insecticides have made parasite control very much easier and we are listening to the death knell of some parasites which we have known in the past. The sheep ked and the louse on sheep have become very rare indeed in this country. Maggot fly is still troublesome, but if modern methods are applied everywhere and applied properly it need not be so.

Tick control in this country has been very much better than before, but we are not by any means at the end of that road yet. As regards scab, we have had only one outbreak this year.

I should just like to say, that no matter how potent an insecticide or drug, it must reach the parasite if it is to be effective. Not only the question of method of application is involved, or a question of whether dipping or spraying or anything else may be the best method, with a disease like scab ; an efficient control must depend on the veterinary measures established.

Although BHC has been a very useful tool it is nothing more than that, and without the wonderful efforts of the Animal Health Division during the past few years we should not have seen scab reduced to its present low level and be so hopeful that it will soon be disappearing altogether.

I think very great credit must go to those who have had to organise the control of scab. It is a dirty job, a winter job and a cold job ; it takes one into parts of the country where conditions are rather wild and it involves meeting people whose natures are rather " agin the Government."

So the new insecticides must have a proper method of application and to be really effective they must be applied under good veterinary direction and in the case of routine procedures, like cattle dipping or tick control, the farmer himself must learn to apply these things in the best possible way.

That is all I have to say to introduce this paper, but we are all looking forward to hearing Mr. Montgomery's remarks relating to his Australian experiences in these matters. (Applause.)

The paper was as follows :—

During the past 10 years or so we have seen remarkable advances in the field of chemotherapy. These have been paralleled in the field of parasite control by the discovery of new chemical substances which are effective killers of a wide range of insect pests. Prior to 1939 our principal insecticides were the natural products—derris, pyrethrins and nicotine—together with relatively simple chemical substances such as arsenic and its compounds, sulphur, and coal-tar phenols. In 1939 came the timely discovery of the

insecticidal properties of DDT. It was timely because when Japan entered the war considerable supplies of pyrethrum flowers and derris were denied to the Allies at a time when the movements of large bodies of troops into insect-ridden areas and the consequent risk of insect-borne epidemics increased the demand for insecticides enormously. At all events, DDT was available in time to protect troops from infection with lice-borne typhus during the Naples epidemic of 1943, and its development provided the impetus for further research and resultant discovery of a new range of effective insecticidal substances. Benzene hexachloride (BHC) developed both in Britain and in France, was another great war-time discovery and since then we have seen the development of numerous other chlorinated hydrocarbons as insecticidal substances. An important characteristic of these new insecticides was the prolonged residual effect which they showed. This was of great importance since it made it possible to deal with insects by single treatments—relying on the residual deposit of insecticide to go on killing by contact long after the application had been made. Table I illustrates the principal synthetic insecticides which are in use to-day for the control of ectoparasites on animals.

These insecticides, and a host of others which have been tested, vary in their activity against different insects. Table II, for example, gives a comparison of the performance of some of the insecticides against the common housefly—an insect which is very useful for accurate testing work.

Table II

Insecticide	LD/50*
Dieldrin	0·0012
Gamma BHC	0·0021
Aldrin	0·0044
Chlordane	0·0079
DDT	0·019
Toxaphene	0·057
Pyrethrins	0·1

* Concentrations expressed as % W/v solutions in kerosene, a dose of 0·4 ml. being applied as an atomised space spray.

The order of efficiency against other insects may be quite different. Thus, for instance, against the American cockroach the order of effectiveness is approximately: dieldrin > aldrin > chlordane > DDT > pyrethrins > gamma BHC > toxaphene. Against the cockroach dieldrin is about three times as effective as chlordane, which itself is about three times as effective as DDT. Against this insect gamma BHC is slightly less effective than DDT, a very different state of affairs from that shown for the housefly. We shall shortly consider how some of these synthetic chemicals have come to be used for parasite control on animals. The older natural insecticides—derris, pyrethrins and nicotine—are still used, but for many purposes they have been superseded by, or reinforced by, additions of the synthetic insecticides. Within recent years we have seen the development of a synthetic chemical substance which acts as a synergist to pyrethrins, piperonyl butoxide, and the widespread use of this material must help enormously to conserve the supply of pyrethrum flowers, of which there is a world shortage.

Let us turn now to the application of the synthetic insecticides to our veterinary problems.

Table I

Common name	Chemical name	Other names
BHC (mixed isomers)	1 : 2 : 3 : 4 : 5 : 6-hexachloro*cyclo*-hexane Benzene hexachloride	HCH
Gamma-BHC	Gamma-isomer of the above	Lindane (99 per cent. gamma BHC)
Chlordane	2 : 3 : 4 : 5 : 6 : 7 : 10 : 10-octachloro-4 : 7 : 8 : 9-tetrahydro-4 : 7-*endo*-methyleneindan	—
DDT	A complex chemical mixture, in which pp′-DDT predominates	Dicophane B.P. (75 per cent. pp′-DDT)
pp′-DDT	1 : 1 : 1-trichloro-2 : 2-di (p-chlorophenyl)-ethane	—
Toxaphene	Chlorinated camphene (67 to 69 per cent. chlorine)	—
Dieldrin	1 : 2 : 3 : 4 : 11 : 11-hexachloro-6 : 7-epoxy-1 : 4 : 5 : 6 : 7 : 8 : 9 : 10-octahydro-1 : 4 : 5 : 8-di*endo*methylenenaphthalene	—

Sheep Maggot Fly Control

Although this problem is of wide geographic distribution its nature is by no means the same in different parts of the world. For this reason, a method of control which is widely adopted in one country may not be so suitable for application elsewhere. In Britain we are fortunate in that our particular maggot fly problem under our conditions of animal husbandry lends itself well to a high degree of control with some of the modern insecticides.

"Strikes" on sheep are caused here almost exclusively by the primary fly *Lucilia sericata*. This fly is potentially on the wing from mid-April to the end of September, though a shorter season obtains in the North. Owing to our variable climatic conditions, "fly" waves may occur at any time during this period and we have no regular hot dry season which can be relied upon to limit the development of strikes from deposited eggs. The most prevalent type of strike is that in the crutch region, especially in flocks with a high rate of scouring, and in young lambs; but body strike is only slightly less common. Although by Australian standards our fly waves would be considered mild, they are of long duration and a seasonal rate of 15 to 20 per cent. is not uncommon. Moreover, economic loss must not be assessed solely on damage to the sheep. The labour of supervision and treatment is of great importance, especially where such work coincides with harvest time or other similar activity on a mixed farm. With a chronic, though low grade, maggot fly problem of this type the provision of effective and prolonged protection becomes worth while.

Prior to the introduction of the modern insecticides, dipping or jetting with arsenic was the most effective chemical means of control, but since the period of protection achieved was only of the order of two or three weeks, frequent treatment was necessary in order to provide protection throughout the season. As early as 1945 (Cragg, 1945) it was shown that a high degree of protection could be obtained for six weeks or more by treatment of sheep with 0·5 per cent. DDT, so that the control of maggot fly for a whole season with a limited number of treatments became a practical proposition. Subsequent field trials confirmed Cragg's findings and showed that BHC was also valuable and often provided a similar protection. However, with this latter agent a number of unexplained failures occurred, and DDT was therefore adopted as the more satisfactory agent for use in this country.

The advantages of this method of control were so outstanding that it almost immediately came into general use.

At this stage the practical application of the new insecticides to maggot fly control had outrun controlled research work. Good results were being obtained in the field, primarily from a DDT suspension yielding 0·4 per cent. p.p.′ DDT in the bath, but precise information was still required on the following points:—

(i) The mode of action of different insecticides.
(ii) The comparative lengths of protection.
(iii) The optimum effective concentrations.
(iv) The effect of different methods of application and formulation.

To obtain all this information from field trials would have been extremely difficult, if not impossible. Field work on maggot fly is notoriously beset with many complicating factors. In the field, the fact that an insecticide-treated group of sheep is not being struck may be due to such factors as a low natural incidence of fly-blow or to low humidities inhibiting the development of larvae, and results are therefore often difficult to interpret.

In order to overcome some of these difficulties we have adopted a controlled method of testing which involves the weekly exposure of small groups of variously treated sheep to a dense artificially-bred population of ovigerous maggot flies. Batches of up to 30 sheep are exposed to the flies in a well-lit enclosed chamber where direct observations on oviposition can be made. Details of this method have been published (Stones, 1951). In our experience this has provided a good comparative picture of the relative merits of different methods of treatment in inhibiting oviposition on sheep. The further ability of the treatment to control larval development is tested by a separate larval implantation test. Together, these methods provide a comprehensive test which not only assesses the comparative protective values of different methods of treatment, but also indicates their relative mode of action. Since the tests are carried out on the body area, complications associated with crutch strike are avoided.

The following table is based on this work and indicates the relative merits of several insecticides in terms of their protective properties and also indicates their mode of action. In Table III, DDT has been taken as the standard, and its anti-adult protection of seven weeks under field conditions is represented by five crosses. All were applied by dipping.

Table III

Formulation	Insecticide	Per cent.	Anti-adult protection	Larvicidal protection
Arsenic/sulphur powder dip	As_2O_3	0·2	Nil	xx
DDT wettable powder	p.p.′ DDT	0·4	xxxxx	xx
BHC wettable powder	Gamma BHC (total isomers 0·5)	0·065	xx	xxxx
Toxaphene emulsion	Toxaphene	0·5	xxx	xxxxx
Chlordane emulsion	Chlordane	0·5	x	xxxxx*
Dieldrin emulsion ...	Dieldrin	0·3	Nil	xxxxx*

* The larvicidal protection imparted by these agents is considerably longer than that indicated, but further tests are necessary to confirm their precise values.

The period of protection is not, of course, influenced solely by the type of insecticide; formulation, method of application and concentration also have an important bearing. The effect of varying some of these, using DDT, is shown in the following results (Table IV).

Table IV

Insecticide and formulation	Concentration	Application	Protection
	% p.p.′		
DDT wettable powder	4·0	Jetted	11 weeks
" " "	0·4	Dipped	7 weeks
" " "	0·4	Dipped full fleece	6 weeks
" " "	0·3	Dipped	7 weeks
" " "	0·2	Dipped	6 weeks
" " "	0·4	Shower dipping	7 weeks
" " "	0·4	Hand spray (½ gal.)	3 to 4 weeks
DDT benzene emulsion	0·4	Dipped	4 weeks
DDT phenolic emulsion	0·2	Dipped	3 weeks
DDT white spirit emulsion	0·2	Hand spray (½ gal.)	4 weeks
" " "	0·2	Hand spray (½ gal.), full fleece	Less than 2 weeks
DDT dry powder	0·4	Powdered	Less than 3 weeks

Note.—Wool length was six weeks' growth at the time of treatment, except where otherwise stated.

Since conditions in this country demand the provision of the maximum possible period of protection, for body strike as well as crutch strike, a DDT suspension at 0·3 per cent. p.p.', applied by dipping, is the method of choice. The application of higher concentrations is uneconomic considering the small increase in protection achieved. We have evidence to show that the dropping of the concentration below 0·3 per cent. p.p.', whilst not in itself serious in its effect, allows too little margin of safety for other adverse factors such as exhaustion of the wash or abnormalities of climatic conditions. Shower dipping of the deluge type, ensuring thorough saturation of the fleece, is equally satisfactory for the control of body strike. Where a lighter type of spray is employed, as with hand spraying, protection is much shorter, especially where sheep in full fleece are treated. A quantity of spray considerably in excess of half a gallon is necessary if any effective penetration down the staple is to be achieved, and efficient penetration appears to be essential for prolonged protection. Of equal importance is the formulation of the insecticide, an emulsion being markedly inferior to a water suspension in conferring long protection.

Another phase of maggot fly control in which the newer insecticides have proved of value is in the treatment of struck sheep. Treatment is, naturally, of secondary importance to prevention, particularly so now that the means of prolonged protection are so much more effective. Nevertheless, even in the best managed flocks a number of strikes is inevitable. The older maggot dressings were often irritant to the lesion and, at the best, provided only a short protection against re-strike. By making use of the larvicidal properties of BHC, bland dressings have been developed which not only kill or expel the maggots, leaving the fleece clean, but also protect against re-strike for several weeks. For this purpose it has been found that BHC in emulsion form is more satisfactory than the water suspension. Both preparations, at suitable concentration, will kill first and second stage larvae and expel third stage larvae, but the protection conferred is more efficient and of longer duration where an emulsion is used.

Control of Sheep Scab

Since the advent of the newer insecticides a very material advance has been made towards the eradication of psoroptic sheep scab, both in the United Kingdom and in countries such as the Argentine, Southern Brazil and South America generally. In the United Kingdom the recorded annual outbreaks of scab have dropped from over 100 in 1945 to 46 in 1949, 26 in 1950 and 16 in 1951, and there is reason to believe that in 1952 the figure will be even lower.

For the dipping of sheep in this country only two of the newer insecticides have received extensive use, namely, BHC and DDT, and as will be indicated later, except in relatively high concentrations, DDT cannot be considered of economic value for scab control.

In 1947 it was shown by one of us (Downing, 1947) that not only would 0·013 per cent. gamma BHC eradicate the disease in a single dipping, but that a period of 56 to 82 days' protection against re-infestation could be obtained experimentally. Further, it is known that during the summer months the acarus, whilst in the "latent" phase of the disease, seeks certain predilection sites on the sheep's body, such as the infra-orbital fossae, where it is not reached by the dip wash unless such sites are hand-dressed at the time of the dipping. During recent years it has been the policy of the Animal Health Division of the Ministry of Agriculture to take areas where sheep scab might almost be termed to be endemic, and with the co-operation of the sheepowners to carry out an intensive eradication campaign involving the gathering and treble-dipping of all sheep in the area. The first of these single dippings has taken place about August, at a time when the acari are leaving or about to leave the latent sites for the general body surface to resume their activities, the second in October and the third in December. This procedure has been repeated for two years after the last reported outbreak in the area. From the substantial drop in the annual outbreaks of scab over the last few years there is no doubt that the policy has paid a worthwhile dividend.

Another step in the right direction has been the recognition of the fact that when sheep are dipped in the normal type of swimbath there is a progressive diminution of the insecticidal concentration in the wash, resulting from the filtering effect of the sheep's fleece. This phenomenon, known as exhaustion or "stripping," is even more marked with emulsion dips than with suspensions. To meet this exhaustion factor the Ministry of Agriculture now requires that a "single dipping type" dip should, on dilution, give a wash containing not less than 0·016 per cent. of gamma BHC at the initial dilution with a replenishment rate of 0·02 per cent. gamma for the suspension types of dips and 0·016 per cent. and 0·024 per cent. gamma respectively for the emulsion dips.

In South America BHC has also proved valuable for the control of psoroptic sheep scab. In the Argentine an initial wash concentration of 0·0085 per cent. gamma BHC is used and double dipping at a 14-day interval is preferred. In Southern Brazil the regulations require that two series of double dippings at intervals of 10 to 12 days shall be carried out, the first within a month of shearing and the second in April at the onset of the winter. In that country areas are scheduled and every sheep, whether infested or not, dipped—the regulations being enforced until the area is declared free from scab. By 1950, although the disease had not been eradicated, the incidence of sheep scab had been markedly reduced and many areas freed.

In most countries sheep scab is a scheduled disease and perhaps there has been less experimental work carried out with the newer insecticides for its control than for the control of other ectoparasites, so that there is comparatively little published information on the subject. We have been able to test a number of these insecticides, but we have been unable to find one that at an economical equivalent wash concentration is as efficient as BHC. Briefly, our results have shown that to obtain complete eradication of the disease in a single dipping the following minimum wash concentrations are necessary, ignoring the question of exhaustion.

BHC	... 0·1 per cent. (0·013 per cent. gamma BHC).
DDT	... 1·0 per cent. (0·75 per cent. p.p.' DDT).
Toxaphene	0·25 per cent.
Chlordane	... 0·25 to 0·4 per cent.

In other experiments the following periods of protection against re-infestation have been obtained :—

BHC	... 0·1 per cent. (0·013 per cent. gamma BHC), 56 to 82 days according to the type of wool on the sheep.
DDT	... 0·5 per cent. (0·36 per cent. p.p.' DDT) (double dipping at 14 days' interval), less than 56 days.
Toxaphene	0·25 per cent., 42 to 98 days.

Cattle Tick Control

The complex problem of cattle tick control is a very important one in many parts of the world, and the synthetic insecticides have made a notable contribution towards its solution.

The one-host ticks of the *Boophilus* spp. are found particularly in Africa, U.S.A., Central and South America, the West Indies, and in Australia. They are important as transmitters of piroplasmosis, apart from the direct injurious effect which heavy infestations exert. Some trouble is caused in America by *Amblyomma* spp., but it is chiefly in Africa that the important infestations of two- and three-host ticks occur (particularly *Amblyomma* spp. and *Rhipicephalus* spp). These, by reason of their short feeding period on the host, are more difficult to control than are the one-host ticks, and they are important vectors of disease. Consequently tick control measures in South Africa are generally much more stringent than in other parts of the world. The control of East Coast fever, in particular, demands very short interval dipping.

In other parts of the world the type of control demanded depends upon the circumstances. In areas where there are no tick-free pastures, on which cattle might be raised or fattened, control measures have taken the form of dipping at intervals of 14 days or longer with the purpose of effecting a useful degree of control while retaining a low infestation sufficient to confer immunity to tick fever. In such countries no attempt is made to eradicate the parasites. In New South Wales and in the Southern States of the U.S.A., eradication of *Boophilus* is the goal. In the Argentine the position is somewhat different. In that country, partly as a result of an eradication campaign and partly owing to climatic factors, there is a tick-infested zone and a tick-free zone. The tick-free zone, south of the 34th parallel, contains the best pastures in the country, on to which cattle bred in the tick-infested zone may be passed for fattening. This traffic in infested animals demands special measures to ensure that ticks are not carried into the free zone, and regulations are framed accordingly. Dips are required to pass an official test involving 500 head of cattle and regulations require that all ticks, including engorged females, should either be killed or that the latter should not deposit fertile eggs. The trial may include one or more dippings at stated intervals.

Prior to the development of the synthetic insecticides arsenical dips were used in all the cattle tick countries, and they gave reasonable, if not ideal, control of the various species of tick. The concentrations generally used were 0·08 per cent. (As_2O_3) for three- to four-day interval dipping, 0·16 per cent. for seven-day, and 0·18 to 0·2 per cent. for intervals of 14 days or longer.

During the past 16 years there has been an increasing number of reports of comparative failure of arsenical dips. In 1936 one of us observed, on an Argentine estancia, that concentrations even as high as 0·8 per cent. As_2O_3 did not give adequate tick control. In 1938 an arsenic-resistant Blue tick was reported from South Africa, and since that time reports of failure of arsenical dips were received from such widely separated countries as Queensland, Brazil and Jamaica.

Many of these apparent failures could be ascribed to bad management and dipping practice, but the presence of an arsenic-resistant tick was proved in South Africa, while in all countries it was obvious that there had been a marked falling off in the results obtained in the field with arsenical dips. Great interest was shown, therefore, when the new insecticides became generally available for cattle tick control. It is proposed here to discuss, briefly, the application of these insecticides to tick control.

Benzene Hexachloride

In 1945 BHC was introduced into the arsenic-resistant tick areas of South Africa. To begin with, it was used successfully against the Blue tick at a wash concentration of 0·005 per cent. gamma BHC, but the need for controlling the two- and three-host ticks, and the occurrence of various troubles in the field, necessitated an increase in concentration.

The most recent regulations in South Africa require the use of BHC at an initial concentration of 0·03 per cent. gamma BHC with replenishment at 0·04 per cent. gamma BHC. This concentration is required for the control of two- and three-host ticks.

In the Argentine it was early shown that cattle could be completely cleaned of tick by three dippings at seven-day interval at a wash concentration of 0·017 per cent. gamma BHC, and this or a slightly lower concentration has been generally used for routine tick control in many parts of the world. In Australia, on the other hand, where the longest possible dipping interval was demanded, BHC has been generally employed at an initial wash concentration of 0·065 per cent. gamma BHC. When freshly used on susceptible Blue tick populations this insecticide requires to be used at a concentration of 0·065 per cent. gamma BHC or more, to clear cattle of all stages of the Blue tick after a single dipping. At this concentration residual protection from fresh larval attack is limited to six to eight days and at lower concentrations is negligible.

In general, BHC has given valuable service for cattle tick control. In East Africa, in particular, its use in combination with arsenic provides a very rapid clearance of East Coast fever on infected farms.

DDT

DDT gives a more prolonged residual effect than BHC, but its activity against engorging *Boophilus* females is poor. It has been used fairly extensively in Australia and is now being used to control the BHC-resistant tick in South Africa. Its prolonged residual protection against larval attack is useful for *Boophilus* control but higher concentrations have been necessary than in the case of BHC. In South Africa, control of the BHC-resistant tick is effected by 0·2 per cent. p.p.′ DDT seven-day interval dipping, while in Australia DDT has been used widely at a concentration of 0·5 per cent. p.p.′ DDT. In the Southern States of U.S.A., where eradication is aimed at, DDT has been used at 0·75 per cent. in combinations with 0·03 per cent. gamma BHC.

Toxaphene

This insecticide has been introduced more recently than DDT and BHC, but there is already a great deal of evidence of its value. Its residual properties are very marked, and at concentrations of 0·5 per cent. it will clear the animal completely of all stages of *Boophilus* and provide protection against re-infestation for at least 12 to 14 days. This valuable property means that for routine control dippings can be spaced at three- to four-week intervals.

These results have been confirmed experimentally in the Argentine, Australia, Jamaica and Brazil, and toxaphene formulations are now coming into use in many countries.

Apart from *Boophilus* control toxaphene has proved valuable for control of *Amblyomma* spp. in U.S.A. and in South Africa. In South Africa it is regarded as the best of the insecticides for Bont tick control, and at seven-day intervals is used at a strength of 0·25 per cent. In U.S.A. higher concentrations and longer dipping intervals are usual.

Chlordane

This insecticide has not been widely used for tick control but its efficiency appears to be approximately equal to that of toxaphene.

Other Insecticides

Parathion has been tested on the one-host tick and is stated to be effective in low concentrations, but toxicity hazards preclude its general use. Some tests have also been made of dieldrin, but information is as yet scanty.

Control of Other Parasites

We have chosen as our main examples the sheep maggot fly, the scab mite, and the cattle tick and we must pass very quickly over some examples of other parasites. Just as the discovery of BHC has revolutionised the control of sheep scab, so it has provided a cure for other forms of mange; sarcoptic and chorioptic mange in cattle, sarcoptic mange of camels, of pigs and of dogs, and scaly-leg of poultry. Treatment of cattle by spraying with preparations containing 0·03 per cent. gamma BHC has cured sarcoptic mange in cattle in two or three dressings and we know of one farmer in Britain who installed a dipping bath for the regular treatment with BHC of his pedigree Shorthorns. Difficulties in exporting have led to the recognition of the widespread occurrence of sarcoptic and chorioptic mange of cattle in this country and far more interest is now taken in their control than there was a few years ago.

The control of lice on domestic animals is relatively easy and these parasites are extremely susceptible to all the modern insecticides. The choice of the insecticide for their control is governed chiefly by questions of cost and absence of risk of toxicity at effective concentrations. Prior to the war derris was much used for general parasite control on the dog, both in the form of dusting powders and washes, and there was naturally a tendency to replace this with DDT, when this material became available. It was found, however, that in this field DDT had no advantage over derris. It had an initial stimulating effect on fleas, very irritating to the dog, and it required 20 to 30 minutes to immobilise the fleas. Moreover, it was not entirely without risk of toxicity. Gamma BHC is an effective and safe insecticide for the control of lice and fleas on dogs, and since it is also effective against ticks it is of great value in areas where dog ticks are troublesome. For infestations of lice and fleas alone, derris preparations have proved satisfactory.

Widespread use in this country of dips containing BHC or DDT, or both, has resulted in a drastic reduction in lice population in sheep, while the sheep ked is now becoming quite rare. Eradication of the sheep ked is achieved if the dip wash strength does not fall below about 0·004 per cent. gamma BHC. In this country many flocks are dipped more than once in the year and concentrations of DDT used for maggot fly control and of BHC in single dipping type dips are more than adequate to deal with keds and lice. In Australia and New Zealand, where flocks are very large and are dipped only once a year, the concentrations of BHC used have been much lower (0·008 per cent. gamma BHC), and where dipping has not been efficient some survival of lice and occasionally of keds has occurred.

We have mentioned the use of the modern insecticides for the control of cattle ticks in countries overseas. Perhaps we should also refer to the control, in this country, of *Ixodes ricinus*. Heath (1951) has shown that both DDT and BHC are highly effective against this parasite and he has shown how on a limited area of grazing where alternative hosts are of little importance, the tick can be eliminated altogether. Our own work has been carried out on sheep and cattle in this country and we have tested DDT, BHC, toxaphene and other insecticides. There is little to choose between DDT and BHC, but it is curious that toxaphene, which is so very effective against *Amblyomma* and *Boophilus* ticks, should be of so little value against *Ixodes* species. The control of the tick on the sheep is limited by cost and toxicity. We have used a preparation containing 0·25 per cent. gamma BHC for the dipping of sheep and obtained almost complete protection for a period of three weeks, but in general it does not prove economically practicable to use concentrations of this order, and farmers have to content themselves with a useful but less complete degree of control. Nevertheless, there is some suggestion that the repeated use of dip washes containing 0·06 per cent. gamma BHC has resulted in a substantial reduction of tick population.

Our experiments with *Ixodes ricinus* on cattle have been less encouraging. We felt that in the case of cattle a complete protection was essential, and we succeeded in achieving this only with weekly applications of a preparation containing 1·13 per cent. p.p.' DDT and 0·13 per cent. gamma BHC. Weekly applications of concentrations of this order would prove much too expensive.

Difficulties and Limitations of the New Insecticides

Toxicity.—The toxic hazards of some of these insecticides are very much less than with some of the older preparations. In the sphere of sheep dipping accidents due to direct toxic action of the insecticide are practically non-existent where DDT or BHC are used in concentrations sufficient for parasite control, but in the days when arsenical and phenolic dips were more widely used accidents were relatively frequent. At the same time, the toxicity of some of the modern insecticides cannot be ignored and in applying them, and in recommending concentrations, we must have in mind the possible toxic effect on the animal and also the possible effect on the human being who is going to consume the products of that animal.

Under normal usage the chances of toxic reaction resulting from the application of DDT are exceedingly remote, but both cats and turkeys are susceptible and this insecticide should not be used for them. DDT, when ingested, or absorbed, is stored in the body fat and accumulates there. It is excreted in milk. In the United States, where DDT has been used on a very wide scale for all sorts of purposes, there is a prohibition on its use in dairies owing to alleged risk to the human population from the regular presence of small amounts of DDT in the milk. In this country regulations permit higher concentrations in foodstuffs than in the U.S.A. but in any case the use of DDT in the United Kingdom has never assumed the proportions it did in the United States.

There is little danger in the use of BHC at reasonable concentrations but, like DDT, the insecticide may be dangerous for cats or turkey poults, while calves under three

months are more susceptible than older animals. BHC has been used with safety on an enormous scale all over the world. Under extremely adverse circumstances of poor condition and severe drought there may be some risk to cattle if concentrations much higher than 0·5 per cent. (total isomers) are used, but under normal conditions the insecticide is very safe.

In the United States food regulations do not permit the use of technical BHC preparations for application in dairies, but since the gamma isomer, while more toxic, is more rapidly eliminated from the body than are the other isomers, the American authorities have permitted lindane (99 per cent. gamma) preparations to be used for the treatment of mange in dairy herds.

When toxaphene was first used as a cattle dip some fatalities occurred as a result of emulsion instability, but these difficulties have been overcome and cattle are now regularly treated with concentrations of 0·25 to 0·55 per cent. Toxaphene should not be used for application to dogs, cats, or poultry.

Chlordane shows a rather similar picture to toxaphene but there is less field experience with this material.

Dieldrin has been used only on an experimental scale, but though its acute oral toxicity is of the same order as that of toxaphene, it is very much more toxic on dermal application and this factor seems likely to hinder its use.

Resistance to Insecticides. — Nature provides numerous examples of the ability of living organisms to adapt themselves to adverse circumstances and the development of a new drug has often been hampered by the appearance of drug-resistant forms of the organism which it is intended to control. In the field of insecticides there have been many examples of this phenomenon of development of resistance. Where the synthetic insecticides have been widely used as residual sprays, resistant populations of houseflies often have appeared, and DDT-resistant flies are known to exist in many different parts of the world. One of the most recent examples of this phenomenon is the appearance on the Korean battlefront of a DDT-resistant louse.

The mechanism of the development of resistance is a subject which invites discussion, but the simple explanation is that from a population exposed to repeated doses of a lethal agent the more susceptible individuals are removed and therefore a process of selective breeding operates in favour of the more resistant individuals.

An arsenic-resistant Blue tick is known to have established itself in South Africa and by 1942 this resistant strain was found throughout the coastal and semi-coastal belts from Port Elizabeth to the Portuguese border. No really satisfactory control of this arsenic-resistant strain was accomplished until 1945 when BHC was introduced. Unfortunately, the concentrations of BHC used generally were set too low and early in 1948 there appeared to have developed a BHC-resistant Blue tick in the East London district. Its presence, suspected by field results, was confirmed by field and laboratory tests (Whitnall *et al.*, 1949) and since that time the BHC-resistant tick has appeared in many areas in South Africa. A BHC-resistant strain of the Blue tick has also been confirmed on a few farms in Jamaica, and the development of some degree of resistance is suspected in isolated cases in some other countries.

It is a curious feature of the BHC-resistant Blue tick of South Africa that resistance to BHC seems to be limited to ticks which are already arsenic-resistant, and that resistance to BHC is accompanied by some degree of tolerance to toxaphene and chlordane. This tick is at present being adequately controlled by seven-day dipping with 0·2 per cent. p.p.' DDT.

Up to the present time there is no authentic record of development of insecticide resistance by two- and three-host ticks. This is understandable. The Blue tick lives on the host for some 21 days or so, and with seven-day dippings at low concentrations may be exposed three times to sub-lethal concentrations of insecticide. The two- and three-host ticks live a much shorter time on the host and many live equally well on alternative hosts so that they will be far less frequently exposed to the insecticide. One would expect, therefore, that resistance was far more likely to develop in a population of *Boophilus* spp. than with any of the two- and three-host ticks.

Other Difficulties.—The development of the modern synthetic insecticides has provided new problems of formulation. These materials are all relatively insoluble in water, and the insecticides have had to be applied in the form of suspensions or emulsions. Exhaustion of active insecticide from dipping washes has to be countered by the use of higher rates of replenishment.

Cattle dipping baths have carried their own special problems. Sedimentation of insoluble insecticide demands care in re-dispersion in the case of suspension dips while emulsion dips are subject to greater exhaustion. The lack of suitable bath side tests has made it difficult to ensure that bath concentrations are properly maintained, though much can be done with careful dip bath management. There have also been difficulties resulting from the pollution of the dipping wash with large amounts of mud, dung and urine. In many cases BHC loses biological efficiency when used over a period of months in a cattle dipping bath and the same phenomenon has been observed with DDT. In the case of BHC we know that under these conditions some destruction of the gamma isomer occurs and there seems little doubt that this is the result of bacterial action in the polluted dipping wash. At present, this problem can be dealt with only by careful dip bath management, keeping the wash as clean as possible, frequent and adequate replenishment, and frequent cleaning out of the dipping bath.

Methods of Application

The efficiency of our control of external parasites will depend as much upon effective application as on the direct lethal action of the insecticide. In general, the most effective means of application is the complete immersion of the animal in a fresh clean wash of the insecticide. For sheep there is no doubt that for general control or eradication of external parasites, dipping is the best method. It is the only method which will ensure the penetration of insecticide to all parts of the skin surface, especially in long-fleeced animals. It is also the most effective method of treatment for cattle, pigs, dogs and other animals. We must, however, for convenience, or by reason of difficulties arising from dipping, also adopt other methods. Reference has already been made to the application of spraying for the control of maggot fly in sheep and to the efficiency of the deluge type of sheep shower. No spraying method gives adequate control of sheep scab.

For control of sheep ticks we have found that spraying of the predilection sites can give results as good as those obtained by dipping but the method is too laborious for large-scale practical control. For parasite control on cattle it is, in this country, rarely practicable to dip because there are very few dipping baths available. Spraying, however, will give good results if thoroughly done. For convenience, lice control is often effected by the application of dusting powders,

though spraying will give good results. Overseas, in countries where tick control is of chief importance, the spraying of cattle is attracting more and more attention. Spraying at weekly intervals presents no great problem in the case of dairy herds, but the economical spraying of large beef herds will be practicable only when efficient power spray races have been developed. Within the past two years our colleagues in Africa have devoted much of their energies to this problem and a great deal of progress has been made.

One of the chief reasons for the growing popularity of spraying for cattle may be found in the difficulty of maintaining, at all times in a cattle dipping bath, an insecticidal wash of known strength and full activity. With the development of improved spraying apparatus spraying will make a big contribution as a method for parasite control on cattle, but dipping will remain the most widely used method, because of its simplicity and the excellence of results where tanks are well managed.

Mention must also be made of a new method which has been evolved since the war—that of "fogging." Various types of generator are used to produce an insecticidal fog to which the animals are exposed. At first sight the method is attractive since it allows the simultaneous exposure of large numbers of animals with a minimum of handling. It is too early to say whether the method will be very generally adopted, but the evidence we have seen suggests that this is not the most economical method of applying a residual film of insecticide on animals. The method may be of value under Australian conditions for the treatment off-shears of very large flocks of sheep, but it seems unlikely that fogging will give efficient coverage of sheep with much growth of wool.

Yet another method which has attracted some attention is the feeding of small amounts of insecticide so as to produce blood concentrations which are lethal to blood sucking parasites. Up to the present it has not been found possible to obtain a worthwhile result without risk of toxicity.

What of the Future?

Since the war, big strides have been made in the control of external parasites, and these have resulted mainly from the synthesis of new and more potent insecticides. As a result sheep scab has been nearly eradicated from this country and very markedly reduced in all parts of the world. The sheep ked and the louse have ceased to be a problem in this country, mange of all kinds can be more readily controlled, tick control has become more efficient and the maggot fly problem has been very greatly reduced. What of the future? We must not be complacent. Research must go on—new insecticides must be discovered and new methods tested. Nature is very adaptable and the development of the BHC-resistant Blue tick in Africa and the DDT-resistant body louse in Korea have shown us that we cannot afford to stand still. Efficient parasite control can make a very real and effective contribution to food production and we must be forever striving to improve our methods, increasing efficiency, reducing labour and reducing costs if we are to add still more to the remarkable advances which have been made in this field.

Summary

Attention is drawn to the development during recent years of a range of new insecticides, commencing with DDT in 1939 and followed shortly by BHC and others. Their marked residual properties have been particularly valuable in rendering a single treatment effective against parasitic infestation, where previously two or more treatments were necessary. It is shown, however, that the order of their efficiency varies according to the species of parasite against which they are employed.

The control of sheep maggot fly both in the United Kingdom and abroad is discussed. Results obtained in the field, and under experimental procedures, using DDT, BHC, toxaphene, chlordane and dieldrin are briefly outlined. The effect of using different methods of application, such as dipping, showering and hand spraying, is also assessed.

The marked reduction in the annual outbreaks of sheep scab in the United Kingdom and certain countries abroad is closely associated with the advent of dips containing BHC. Reasons for this are suggested and a brief review given of the comparative efficiencies of some other insecticides.

The newer insecticides are shown to be useful in the control of one-, two- and three-host cattle ticks but their value is influenced both by the tick species and by the local cattle husbandry methods. The wash concentrations at which these insecticides are generally used under different conditions are briefly enumerated.

Other parasitic diseases, including mange, lice and sheep tick (*Ixodes ricinus*), are dealt with more briefly, and some consideration is given to the toxic hazards associated with the use of the modern insecticides.

The phenomenon of the development of resistance to insecticides by certain species is reported. This has arisen particularly with one-host ticks but has not so far been observed in the two- and three-host varieties. The use of modern synthetic insecticides has also given rise to difficulties connected with the exhaustion of the active ingredients from dipping washes and, in cattle dipping baths, from actual loss of biological efficiency. Attention is drawn to these problems and finally a brief review is given of the various methods of application in current use.

References

Cragg, J. B. (1945.) *Nature.* **155.** 394.
Downing, W. (1947.) *Vet. Rec.* **59.** 581-2.
Heath, G. B. S. (1951.) *Parasitology.* **41.** (3/4). 209-223.
Stones, L. C. (1951.) *Bull. Ent. Res.* **41.** (3). 503-521.
Whitnall, A. B. M., Thorburn, J. A., Whitehead, C. B., McHardy, W. M., & Meerholz, F. (1949.) *Nature.* **164.** 956-957.

The Chairman: We are very fortunate to have here to-day Mr. Montgomery, from Australia, who is on a tour of this country and other European countries, and I do extend a most hearty welcome to him. He has kindly agreed to open the discussion. He has had quite considerable experience of internal parasites in sheep and I believe during the past few years he has devoted his efforts to external parasites. He is going to tell us something about the problems and achievements in Australia, where they have, in fact, had some notable successes in the eradication of ectoparasites, as you will learn from him. (Applause.)

DISCUSSION

Mr. I. W. Montgomery, B.V.Sc. (Syd.) (I.C.I. of Australia and New Zealand), who opened the discussion, said: At the outset, Mr. Chairman, I wish to make three acknowledgements. Firstly, on my own behalf I express my sincerest thanks to the British Veterinary Association for the honour they have done me in inviting me to open the discussion, as an Australian veterinarian, of this most valuable paper—I am deeply conscious of this

privilege and of the opportunity to attend your annual Congress and I hope my contribution will add something to the general world-wide picture of modern insecticides and ectoparasite control.

Secondly, sir, I wish to pay tribute to the excellence of the paper just presented by three of the acknowledged leaders in the field of ectoparasite studies. This paper gives a most useful, up-to-date summation of present-day knowledge of insecticide usage, and as such is a most valuable contribution to this Congress, particularly in so far as it permits many of us to acquire a knowledge which would not otherwise be possible owing to activities in other directions.

Finally, I wish to acknowledge the assistance of two of my Australian colleagues, Mr. H. McL. Gordon, B.V.Sc., Chief Parasitologist of the C.S.I.R.O., and Mr. N. P. H. Grahame, B.V.Sc., who for many years concentrated on field and laboratory studies in the ectoparasite field with the C.S.I.R.O.; I had the opportunity of discussing this paper with both these workers before leaving Australia. They gave me many useful hints. I will, in my reference list, acknowledge other Australian workers to whose publications I have referred.

To turn to the paper itself, I propose to discuss it within Australian lines; time does not permit discussion of the opening sections except to emphasise the points made in respect to the necessity of selecting the insecticide to be used in relationship to the problem to be tackled and the impossibility of comparing relative efficiencies of insecticides with insects in general. I would also note that our general Australian experience is that cockroaches of the American type, particularly the larger roaches such as *Periplaneta australis*, are more susceptible to BHC than DDT.

Sheep Maggot Fly Control.—This is probably the most important section of the paper and here we will find the greatest variation in methods applicable in Britain, compared to Australia. We know this condition better as blowfly strike and it is a problem of major importance to us in Australia where in certain seasons sheep blowfly strike is probably more severe than anywhere else in the world. First, our important primary fly is *Lucilia cuprina*; whilst *Lucilia sericata* is present in Australia it plays no part in the Australian blowfly problem. This may be due to the environment and the lower population density, but on the other hand, the Australian and British sericatas may be distinct species. Secondary flies are also important in Australia. These are Chrysomyia, Microcalliphora, and Sarcophaga species. They rarely initiate a strike, but attack already struck areas, extending and increasing the severity of the strike. Seasonal conditions in Australia vary considerably from British, as do animal husbandry conditions. These two factors affect the incidence of strike and methods of control adopted. It is usual in the winter rainfall and southern areas of Australia, when conditions are suitable, to experience two short but severe fly waves in spring and autumn. In the northern section of the country, predominantly a summer rainfall area, peaks of fly strike still occur but are not so pronounced and with summer rains strike may occur throughout all the warm months. Recent rainfall, rather than atmospheric humidity, appears to be the critical factor. Strike, in the main, is crutch strike, but in years of high rainfall and a tendency to abnormal fleece conditions such as fleece rot, body strike is of major importance, this being particularly so in the 1950-51 heavy rainfall years. Stock raising in Australia is based chiefly on one-crop husbandry whilst a few cattle may be run with sheep or sheep may be kept on mixed farms in conjunction with cereal growing. The great majority of our sheep are run on properties devoted practically exclusively to sheep and consequently the grazier directs the whole of his working energies towards his sheep flock maintenance. In Australia the first line of attack for the control of crutch strike is one to provide that sheep are not attractive to the fly. This may be done by the selection of plain bodied types free of body folds and wrinkles, particularly in the crutch, or by the adoption of a surgical operation known as the modified Mule's operation, which provides for an enlargement, by stretching, of the bare area of the crutch surrounding the urogenital opening. This practice is combined with docking of the tails at marking time to the optimum length of "medium long" and ensuring that the incision has been made to leave a ventral flap of woolless skin. Where tails are cut short, a special tail strip operation is performed to allow woolless skin to stretch over the stump. In areas where sheep are more plain bodied, crutching, the shearing of wool around the breech, is practised just prior to anticipated fly waves and as a routine prior to lambing. These methods work on the principle that prevention is better than cure.

Insecticidal methods of control of crutch strike rely mainly on a system of jetting or occasionally spretting. These systems aim at applying, under pressure to ensure thorough wetting of the wool, insecticides which will prevent oviposition or development of larvae after sheep become struck. Jetting can also be used for control of body and poll strike. Initially sodium arsenite (0·7 per cent As_2O_3) was used, but later calcium arsenite (1·0 per cent. As_2O_3) was found more effective. More recent work with DDT and BHC as jetting fluids has shown these materials to be preferable to arsenic where severe strike has already occurred or for control of body strike. One per cent. p.p. DDT or 0·05 per cent. gamma BHC is recommended, with a preference for DDT owing to the longer residual efficiency when used before a fly wave commences, but once a wave is in progress BHC is to be preferred owing to its larvicidal effect. However, there is no evidence that the newer insecticides have any advantages over calcium arsenite as jetting fluids for the control of crutch strike when used before a strike wave commences. The period of protection of about six weeks being the same with all mentioned insecticides, the paper under discussion suggests that the protection period resulting from arsenical jetting was shorter than that provided by jetting, *e.g.*, with DDT. That is not our usual Australian experience.

We note next the preference for dipping in 0·4 per cent. p.p. DDT for sheep blowfly control in Britain. Jetting still remains our preference, as crutch strike is normally our greatest cause of worry and consequently jetting of the crutch area is more economical than complete dipping. The authors have shown the difficulty of determining information from field trials and mention one of the difficult factors as being inhibition of larval development by low humidities in the field. We do not consider atmospheric humidity an important factor; the major proportion of our strikes occur after repeated rainfalls and in times of low humidity. The micro-humidity of the struck area seems to have some importance and provided the maggot lives for 24 hours *Lucilia cuprina* appears to create its own humidity and strike continues even when atmospheric humidity is quite low. On the other hand, on many occasions we have found difficulty in applying results obtained in the insectary to work in the field and consequently many of our determinations in this problem are from results obtained after field trial. The insectary is important, particularly for basic work and the screening of insecticides, but we believe such results must be fully evaluated in the field before they are of practical value. The greatest difficulty then is the forecasting of fly strike waves so that well-controlled field trials can be conducted. One of the reasons for difference in the results from artificially induced strike and the naturally occurring condition appears to be in the nature of the strike itself. Single strike with one deposition of eggs is rarely serious; the majority of such strikes dry out and have little or no effect on the body weight or wool production of the sheep. In bad fly waves restrike is all important when sheep are attacked on a number of occasions over a series of days and eggs to fully grown larvae are found in the wound.

Reverting to the insecticides themselves, there are a number of important factors to be considered, including the concentration of the insecticide to be used and the method of application. For jetting purposes or for surface spraying, and particularly the latter, 1·0 per cent. DDT or 0·5 per cent. gamma BHC is recommended and it has been determined that 0·2 per cent. DDT has very low protective efficiency, a minimum strength of 0·5 per cent. being required. It has also been shown that BHC will not give as good protection as DDT when sprayed on the sheep unless the insecticide is thoroughly distributed through the wool. Therefore, as a general rule, a higher volume of BHC fluids is required for jetting than DDT, generally a minimum of $\frac{1}{2}$ gallon per head for body strike control compared to $\frac{1}{4}$ to $\frac{1}{2}$ gallon per head for DDT.

There is a preference in England for plunge dipping, using a strength of 0·3 per cent. p.p. DDT; whilst not used by us to any great extent, there is some evidence that plunge dipping using DDT at 0·3 per cent. p.p., BHC at 0·05 per cent. gamma, or DDT through power spray dip at 0·4 per cent. p.p. will give adequate control of body strike. Dipping has some disadvantages when sheep are in long wool; fleece staining may occur and whilst most uncommon, heavy mortalities and post-dipping disorders have been recorded following this dipping procedure. Spraying, either hand or power, appears to be the most rapid method of applying protective insecticides to sheep, provided fleece wetting is ensured either by first lightly wetting the sheep with water before applying the insecticide or by adding wetting agents to the preparation at the full recommended quantities.

Finally, my impression is that in Britain *Lucilia sericata* strikes have a marked toxic effect on the sheep and as the maggot appears to invade the tissues deeply, the toxic effect may be even more severe than the Australian *Lucilia cuprina* strike where the maggot invades the areas lateral to the strike. Treatment of such strikes is all important and by virtue of the larvicidal properties of BHC it is now possible to prepare bland dressings with the exclusion of the older irritant larvicides which in themselves caused tissue destruction and scab formation. In addition, the residual insecticidal properties of BHC protect against restrike. There has been some tendency to prepare such dressings with high wetting properties to permit of direct application to the fleece without the necessity of shearing the affected area, thus saving labour and wool. In theory this is very good, but with lateral invasion of maggots, the effects of which are not shown on the surface, particularly in dense-wooled merinos, it is very easy to miss infested areas not completely clipped. An important practical point is to ensure that an effective larvicide is applied to the maggots before they are clipped off and allowed to fall into the ground and pupate.

Scab.—Sheep scab does not occur in Australia although it was present in the latter years of the nineteenth century and may have become a serious menace to the Australian wool industry. However, by virtue of rigid control, using polysulphide and nicotine sulphate dips, it was eradicated in 1896. Australia has always been very dependent on its wool industry and every endeavour must be made for positive control and eradication of any disease which may have serious economic effects.

In 1941 a small skin-burrowing mite (*Psorergates ovis*) was identified in Australian merino flocks and this mite may have been present but unidentified for 40 years. It is fairly widespread, although generally only a small percentage of a flock are seriously affected. Little is known of its life cycle and it does not appear to spread rapidly. Clinical symptoms are very similar to body louse infestation, with which condition it is often confused, and microscopic diagnosis is made from deep skin scrapings. Psorergates has also been identified in the U.S.A. It was shown that lime sulphur dips containing 1 per cent. w/v polysulphide sulphur with a wetting agent gave complete control. Lime sulphur dips, however, have certain disadvantages and in view of the excellent results obtained with BHC in scab control, similar dipping material containing up to 0·056 per cent. gamma isomer was tried, but with disappointing results. Whilst the mite populations were reduced there was no residual protection and infestations soon regained their pre-treatment levels. This was a disappointing failure for one of the most potent of the newer insecticides.

Cattle Tick.—In Australia cattle tick is limited to the northern states of Queensland, Northern Territory and the northern Kimberley region of Western Australia with an extremely small area of the north coast of New South Wales carrying a small infestation. In New South Wales attempts have been made for some years to eradicate cattle tick, and whilst this eradication campaign has been successful in the more southern portions of the north coast, success has not been complete in some of the more northern portions of the small infested area of this state. Possibly there are many reasons for this, but it is not at all clear why this is so. It may be due to the difficulty of ensuring regular rapid treatment of all potentially infested stock in areas where mustering, and handling of every head of stock is somewhat difficult; or it may be due to the particular meteorological conditions existing where the campaign is being undertaken. It is of interest to note that eradication has been successful in the southern states of the U.S.A., but here climatic conditions vary very considerably from the north coast of New South Wales. In Texas, for example, in the winter months freezing temperatures are experienced for quite a long period and the other extreme occurs in the summer months. Our climates on the north coast of New South Wales are much milder and except for occasional frosts the severe winter climates of the United States of America are not experienced. Our conditions presumably would permit of easier regeneration of tick populations and may be one of the primary factors in eradication and account to some extent for the failure to achieve the success which has been obtained in the U.S.A. Mention is made in the paper of the residual effect of DDT, but it is rather doubtful just what the value of this residual effect is, and it has been noted in Australia that after a dipping in 0·5 per cent. p.p.i. DDT larvae may be picked up after three days. With BHC the biological efficiency, particularly in the control of the engorged female, appears to be much better than DDT, but we cannot help thinking that the adoption in South Africa of a wash concentration of 0·005 per cent. gamma BHC, combined with their short interval rapid dipping, gave rise to the early appearance of a BHC resistant tick. It would appear that this is a case where repeated applications of insecticides with fewer than 100 per cent. efficiency have given a chance for development of insecticide resistance. In Australia wash concentrations of 0·065 per cent. gamma have been used and it can be stated that dips generally are operating at concentrations of 0·035 per cent. to 0·05 per cent. gamma, and even at this concentration (10 times that used in South Africa) we are concerned that there may be a development of an insecticide resistant tick. When this problem is considered it must be remembered that the development of resistance is probably related equally to the inefficiency of methods of application and to the use of sub-lethal doses. Examination of dip washes, be they based on DDT or BHC, shows that there is a tendency for a fall in concentration to occur, and it appears that this is related in part to the introduction of organic material and bacteria into the dips during the passage of cattle, and the absorption of the active insecticide in the clays, and possibly bacterial breakdown. It is interesting to note that in many of the dips examined a sludge develops on the bottom and that it is very difficult to disperse this sludge in a dip wash prior to the commencement of the dipping programme; consequently, in many cases, the first cattle to be passed through the dip may receive too low a dose. This can also occur in spray dipping. Again, if careful attention is not paid to the maintenance of concentrations by adequate replenishment, the stage may be reached where sub-lethal concentrations are applied. The problems of dipping appear now to be more the problems of determining an efficient method of application and an efficient formulation of the insecticide. There were many years of arsenical dipping before the advent of the arsenic resistant tick. Ticks resistant to BHC have been discovered much more quickly and the fundamental difference between the insoluble chlorinated insecticides and the soluble arsenicals appears to be the crucial difference in the usage of these products. It can be generally expected that the modern insecticides under discussion have high biological efficiency in their uncontaminated form, but we do not know the most efficient way of either formulating these materials or applying them. By way of example, a DDT preparation appeared on the Australian market some years ago which was almost of a colloidal nature and work conducted in Queensland by research authorities there indicated that this material was efficient for the control of cattle tick at a concentration of 0·5 per cent. p.p.i. or for cleansing dips at the rate of 1 per cent. p.p.i., but these same research authorities were quite adamant that any other formulation of an emulsion or dispersible powder type had to be used at double the recommended strengths of the so-called colloidal material. This is only a pointer to the direction in which investigations might proceed, and in Australia we are not at all sure that the preparation of colloidal dip washes is the answer to our problem; it is obvious, however, that we must attempt to find ways and means of formulating our new insecticides so that with proper application they will remain fully effective, otherwise constant difficulties will

be experienced in maintaining satisfactory control of parasites generally.

Control of Other Parasites.—I can make only brief reference here to other usages of modern insecticides and would mention the use of BHC or DDT washes which have been adopted successfully for control of the dog paralysis tick *Ixodes holycyclus* on the eastern seaboard of Australia. I would also emphasise that present evidence indicates that the many reported failures of BHC dips to control sheep louse in Australia have been due to inefficient dipping. This may arise from many causes, but there is no doubt that adequate control of dip wash strengths is far more difficult with suspension or emulsion type dips than with the older solution dips. BHC used in laboratory trials or correctly used in the field has completely controlled sheep louse at strengths much lower than its present recommended usage rate.

I do not intend to discuss toxicity, concerning which many papers are available for reference.

Resistance to Insecticides.—The authors mention that this is a subject inviting discussion. I would like, therefore, to mention briefly some thoughts I have on this matter. I have a feeling that the residual effects of the newer insecticides may be dangerous under certain circumstances. In the control of epidemic disease such as blowfly strike in Australia great use can be made of this residual efficiency and the same applies to the control of certain external parasites, *e.g.*, ked of sheep, in countries where single annual dipping is practised and when the residual efficiency is sufficient to last the complete life cycle of the parasite concerned.

Harrison (1952) has given an excellent general summary of our present state of knowledge of resistance and it is not yet possible to define clearly all phenonema of resistance or to understand how resistant strains arise in the field. There is evidence of a genetical inheritance of resistance which may be controlled by a single recessive gene, or by multiple factors. It has been suggested that the application of multiple sub-lethal doses will produce resistant strains, but this is by no means proven and is not the case in the development of the resistant housefly. However, if a dose is used which kills only a proportion of slightly resistant strains then resistance is increased rapidly. In any population there are probably some individuals with factors making them more resistant to application of insecticides; whether this is a natural occurrence or result of mutation does not really matter. When such individuals are the survivors of a treatment which is less than 100 per cent. efficient there must be a tendency for the increase of numbers and degree of resistance of the insect concerned.

Reverting to the veterinary use of insecticides, we might expect resistance to be recorded, when a dose is repeatedly used that does not give a 100 per cent. kill and a resistant population is therefore built up. If we consider residual value of insecticides as an important factor in control measures, is it not likely that by relying on this factor we will tend, at some stage, to reach a time lag after the initial application—a state where a 100 per cent. of the reinfesting or developing ectoparasites are not being killed, and consequently a resistant population is created? For example, if we assume that the residual efficiency of, say, DDT for reasonable control of cattle tick in Australia permits of long interval dipping of six weeks or more, is not the concentration in the coat of the animal going to decrease as a result of breakdown over a period of time to that stage when all reinfesting larvae are not being killed and so by selection after repeated dippings a resistant race may be created? It might, therefore, be suggested that where the ectoparasite problem is epidemic and of short duration as, *e.g.*, blowfly strike, or where the life cycle is relatively short and reinfestation from outside source uncommon, *e.g.*, ked in sheep, the residual properties of the chlorinated insecticides can be used to advantage. However, where reinfestation is likely, *e.g.*, cattle tick, the residual properties of insecticides may have some disadvantages and in these cases it is preferable to use the insecticides of the highest killing properties and not with the longest protective potential.

Methods of Application.—The development of improved methods of application and formulation appears to be all important in the effective use of the newer insecticides. Many of the older insecticides were water soluble and formulation and application were less complicated than with insoluble materials. Soluble arsenical dips were developed to a pitch of high efficiency over many years and method of usage became simplified and less subject to human error. It took a long while for resistance to arsenic to develop. It happened rather rapidly with BHC in cattle tick control in South Africa. I made reference earlier, when discussing cattle tick, to the variable results obtained with different formulations. Barlow and Hadaway (1952) have drawn attention to some of the factors affecting the availability of contact insecticides and have produced evidence that the physical nature of the formulation and the insecticide affects the biological efficiency. I feel confident that further advances can be made by closer study of these factors with the eventual improvement of formulations.

Much the same applies to methods of application where development is further complicated by the requirements of the local conditions in varying parts of the world, *e.g.*, fogging was of great appeal in the Australian western country where water was short, but unfortunately to date the results obtained have not been sufficiently effective to make the adoption of this method possible.

As a final remark, I fully agree that big strides have been made in the development of new and potent insecticides and in the control of ectoparasites. I would suggest, however, that in our future work the emphasis be placed not on the search for new insecticides, but on acquiring a more detailed knowledge of the ecology and development of the parasites to be controlled or the host parasite relationship. I would also agree with Coyne (1948) that of greater importance than the discovery of new insecticides is the improvement of formulations and method of application of existing insecticides, and concentration on those entomological problems for which these groups of insecticides are not particularly effective.

References

Barlow, F., & Hadaway, A. B. (1952.) *Bull. Ent. Res.* **43.** 91-100.

Coyne, F. P. (1948.) Int. Congr. Pure and Applied Chem.

Grahame, N. P. H., & Scott, Marion T. (1948.) *J. C.S.I.R.* (Aust.) **21.** 266-274.

——— & Montgomery, I. W. (1949.) *Aust. Vet. J.* **25.** 238-250.

———. (1943.) *J. C.S.I.R.* (Aust.) **16.** 206-214.

Hadaway, A. B., & Barlow, F. (1952.) *Trans. Roy. Soc. Trop. Med. & Hyg.* **46.** 236-244.

Harrison, C. Mary. (1952.) *Ibid.* 255-263.

Johnstone, I. L., & Scott, Marion T. (1951.) *Aust. Vet. J.* **27.** 79-82.

Joint Blowfly Control Committee. (1950.) C.S.I.R.O. (Aust.) and N.S.W. Dept. of Agric. and Queens. Dept. Agric. & Stock-Interim Recommendations. Control of Body Strike in Sheep.

Norris, K. R., Roulston, W. J., & Snowball, G. J. (1950.) *Aust. J. agric. Res.* **1.** 165-177.

Roberts, F. H. S., & Moule, G. R. (1951.) *Aust. Vet. J.* **27.** 35-39.

Scott, Marion T. (1948.) *Ibid.* **25.** 300-301.

Seddon, H. R. (1951.) *Aust. Dept. Hlth Serv. Publ.* No. 6.

Shanahan, G. J. (1948.) *Agric. Gaz. of N.S.W.* May.

———. (1951.) *Ibid.* May.

———. (1951.) *Ibid.* August.

Waterhouse, D. F. (1947.) *C.S.I.R. (Aust.) Bull. No.* 218.

——— & Paramonov, S. J. (1950.) *Aust. J. Sci. Res.* **3.** 310-336.

———, & Scott, Marion T. (1950.) *Aust. J. Agric. Res.* **1.** 440-455.

General Discussion

Mr. I. L. Johnstone (Australia): He wanted first to take the opportunity of thanking the British Veterinary Association for giving him a chance to attend the Congress for a few days. It had been a most enjoyable experience. The only thing he could do in following Mr. Montgomery, who had given a very good and complete picture of the Australian position, was just to focus attention on certain points.

There was perhaps a little confusion regarding the situation in Australia, where the position was rather less complicated than in Great Britain, because in Australia an endeavour was made to separate body strike from crutch strike. Some of the experiences Mr. Montgomery had mentioned appeared to apply to body strike, but not to crutch strike. Crutch strike in Australia was very largely

controlled by the Mule's operation and jetting was going out of common use as a preventive method of control. That was not so in all areas but the trend was in that direction.

It was his experience with British breeds of sheep that it was possible to decrease and practically eliminate crutch strike under Australian conditions by the use of the Mule's operation. Not knowing what would happen if the technique were applied in this country, he did not feel competent to suggest whether this would prove a practical method.

In the control of body strike, protection ranged from the protection that was obtained by fogging with a high concentration on the one hand, to a complete dipping in a bath with a rather lower concentration on the other. At the one end there was protection but not very much ; at the other end there was more or less complete protection. In Australia they went between the two extremes. Sheep could not be dipped because of staining the wool and lowering of the wool price. They therefore concentrated on an intermediate course, using a spray, and had put up concentration towards the higher end. In this country it was the practice to dip rather more frequently in a lower concentration.

From his experience in the hill country of Great Britain it seemed that very good protection was obtained. It appeared that the fly was continually subjected to a concentration which was just on the border-line of efficiency. The work of research here had been to establish a minimum concentration that gave efficiency, and he felt that the concentration point of 0·4 per cent. DDT was getting close to that. It was possible that this might help in the development of a resistant strain of fly, if that was possible with *Lucilia sericata*.

Under Australian conditions, people were rather more fortunate in a way, in that it was not always possible to apply the criterion of prevention being better than cure because very often it was not known when fly waves were going to commence and, in those circumstances, it was necessary to start control methods after a fly wave had already commenced. He said that was fortunate, because it seemed that there would always be a population of flies developing in the absence of DDT, and it was one reason why he had always been inclined to favour the higher concentration of DDT rather than a concentration which went down to the rather critical levels.

The speakers tended, in his opinion, to put too much emphasis on the word "concentration." Effective fly control related to the amount of insecticide on a given area, which might be quite detached from the factor of concentration in the wash. Control depended on how much dip remained on the sheep, and in Australia there was a certain amount of evidence to suggest there was better protection with a greater volume than with a greater concentration. The emphasis was on volume rather than on concentration, but that referred specificially to the circumstances where only the back and side areas of the sheep were being treated. In the case of dipping, the suggested concentration was a fairly accurate representation of what should be used.

Mr. T. Spence (Weybridge) : He wished to add his compliments to those already expressed to the authors and to Mr. Montgomery for their very wide survey on the use of modern insecticides.

The authors were right in their prediction of the low incidence of scab for 1952, for to date there had been only one outbreak, and that a very small one, in sheep on one farm in Herefordshire in which the infestation probably originated in the notorious Black Mountain area of South Wales. Indeed, we might look forward to celebrating the final eradication of the disease from the country in the very near future.

This eradication, however, was not only the result of using the new insecticides of recent years, but was also the culmination of a long attritive campaign which, with the old types of dips, had slowly reduced the incidence and distribution of the disease. It was as well to remember that even with the old imperfect dips, scab was cleared from the mainland of Scotland before the beginning of the war and that final eradication in that kingdom was achieved in early 1941 when the last remnant was cleared up in South Uist. "But before we Scots congratulate ourselves, it is as well to recollect humbly that we lagged some 70 years behind our Australian colleagues in achieving this result and lest Dr. Montgomery himself should be too greatly inflated with pride at this success, this eradication was achieved with a minimum of veterinary intervention and indeed in New Zealand the disease, once rampant, was stamped out 10 years before the first veterinary surgeon crossed the Tasman Sea and set foot in that island." All this eradication, of course, happened many years before compulsory dipping was first introduced into this enlightened cradle of agricultural progress. In Britain, however, there could be little doubt that eradication had been delayed by the widespread use of inadequate dips such as tar-oil emulsion types, whose bath-behaviour made them quite unreliable.

With the introduction of B.H.C. a new regime of scab-dip approval was developed in the Ministry and instead of a manufacturer's dip being examined and its approval based simply on its chemical analysis, the new dips were subjected to more exhaustive biological tests and none was approved without testing their actual curative effect on infected scabby sheep and their protective effect in providing a cover against infestation. As the behaviour of the dips had become better known they had increased their demands on the manufacturers and now required a preparation which would be used at a bath strength several times more concentrated than that which was necessary to cure encrusted scab. This apparent timidity had been justified by their successful eradication of the parasite before it had had a chance to develop the insecticide-resistant strains which seemed to characterise campaigns, such as those of tick-control, in which attempts to reduce the concentration of the toxicant in the dipping baths to the lowest near-effective level had, by progressive selection, built up populations of arsenic- or BHC-resistant ticks.

Mr. Downing had hinted at the importance of the latent phase of sheep scab in which scab mites retreated to unsuspected hidden sites on the body during a period when the disease underwent an apparent recovery on the rest of the animal. By far the most important of these sites were the aural tubes : at Weybridge they found that over 80 per cent. of the sheep harboured mites in this organ. The importance of this latent site had been borne out when they found that when sheep were dipped, the mites in the ears, especially in the depths of the ear, were sometimes not reached by the dipping fluid and in some sheep which had been dipped in an arsenical or tar-oil dip these surviving mites did persist long enough to re-establish scab. The survival of mites in the ears seemed an adequate explanation of the relapses which had sometimes followed carefully dipped enclosed flocks in days gone by. In sheep dipped in BHC, on the other hand, while on some occasions mites did survive the dipping unreached by the biocide, this survival did not last more than a few days. They were then killed, either by the fumigant effect of the BHC or by the re-excretion of the biocide in the sebaceous secretion of the ears, following absorption and translocation in the systemic circulation.

The authors reported the successful treatment of sarcoptic scabies of cattle by means of BHC ; they (the Weybridge workers) had some experience with chorioptic scabies and had been unable to effect eradication without very careful hand treatment of the predilection sites, especially the deeper reaches of the groin and the depths of the umbilicus. These sites were not easily reached by spraying techniques and in Shorthorn cattle, especially during the winter when the coat was long and thick and heavily impregnated with grease, the fluid of a dressing was very rapidly shed. A very tenacious viscid preparation was required for the hand treatment of these sites.

Mr. Montgomery and Mr. Johnstone had both drawn attention to the differences between body strike and breech strike and to the successful control of this latter form in Australia by means of Mule's operation and crutching. It seemed likely that proper crutching would reduce the incidence of breech strike in Britain, but of course body strike remained an insecticidal problem. Although we did not suffer the great periodic body strike waves of Australia, this form of the disease was still of importance in Britain.

Experience of sheep blow-fly in both countries had made him realise that it was far from being identical with the disease as we knew it in this country. Certainly the attitude to it was different, in that it had been the subject of an immense amount of veterinary investigation. In Australia, he was impressed by the relatively less severe effects it had on the sheep compared with the devastation the disease appeared to work on individual sheep in Britain. Penetrating wounds were uncommon and instead the maggots seemed to spread over the skin rather than invade into it. The sheep themselves seemed to react differently when attacked and merinos were often seen grazing normally and keeping up with the mob with extensive strikes which would have sent our sheep skulking into the undergrowth to die.

Very bland maggot-dressings were widely used in Australia and commonly these were applied without a preliminary cleaning-up or shearing of the struck area ; the wool over the affected area, instead of being shed, usually continued to grow and provide the sheep with an unblemished appearance. In Britain, on the other hand, caustic preparations were still in common use. This treatment seemed to cause as much damage as the maggots themselves, so that sheep recovered from fly strike usually presented large areas of denuded inflamed skin which many shepherds regarded, wrongly, as a normal sequel of the disease.

Mr. G. C. Brander (Berkhamsted) : The veterinary officers of the Ministry had done pretty well during the week as far as compliments were concerned, so it would be fair enough to make one or two points of criticism. In connection with the Ministry and the research organisations of the Ministry in this country, he felt that

they had played a very small part in the control of ectoparasites, and that at the moment most of the parasites in domestic cattle and sheep were controlled more by chance than anything else.

One need consider only such parasites as the maggot fly, sheep tick, lice on cattle and mange on cattle. There were very few definite recommendations made to farmers on the control of those parasites and there was really no definite system of control laid down.

Speaking personally, he was rather worried as to what would happen when sheep scab was finally controlled. As they knew, there was a compulsory dipping order, and although there were such things as dipping baths on farms in many cases they had been there for 50 years and had been used for purposes other than dipping.

The system of calibration on the baths was often far from accurate and it seemed quite amazing that the amount of control of scab and maggot fly which existed was obtained at all.

Once sheep scab was controlled the Ministry would have to decide what system to adopt to ensure that sheep were dipped, under existing regulations. Many people dipped their sheep merely because the regulations were there, but did not particularly care whether the dipping controlled anything.

With regard to cases of sarcoptic mange in cattle, he had found that one could control this disease by spraying with BHC in the form of a suspension, and on one big farm in Windsor with a large number of affected cattle three treatments had completely eradicated sarcoptic mange from the herd.

As far as sheep tick was concerned, this disease presented a very serious problem in many hilly areas in Scotland and Northern England, but the farmers did not really know quite what they were doing in the matter of control. They saw ticks on their ewes and lambs and they dipped the sheep at convenient times, but as far as control or eradication was concerned they really did not know where they were going. The next move of the Ministry might be to do something positive about the control of sheep tick.

Maggot fly was controlled to a large extent as a result of the use of the new insecticides, but the point he really wanted to bring out was that it was a great pity to see the new insecticides, which were so much more efficient than the old, being used in such a haphazard form.

Mr. M. H. Blunt (New Zealand): He was not a small-animal practitioner, but had been working on a part of the north-east coast of New Zealand where fly strike was a very serious problem. The mortality or morbidity among the sheep was very difficult to estimate there, but of the numbers that died half of them were probably never found.

The fly wave extended through at least half the year and in some cases there was fly strike in sheep throughout the year. The people there had heard of some of the predisposing causes, such as humidity and heavy rainfall, but he had seen the trouble there in periods of very good weather.

Was it considered that the heavy dew in that area, and possibly in some other districts, would be a predisposing cause, in that it wetted the crutch of the sheep and so made sheep attractive to the sheep blowfly?

New Zealand had a large population of sheep dogs in the district and mange, fleas, and sometimes lice, were very prevalent. On one or two sheep stations he had managed, by the use of BHC and the regular bathing of the dogs and by spraying around the kennels, to control all those ectoparasites. He considered that the use of BHC was an excellent method of treating mange in the dog.

Dr. Alexander (South Africa): He was very mindful of some remarks made by a delegate from Frant on the previous day. People in South Africa had a very considerable experience of the control of ectoparasites and a knowledge of some of those experiences might be of value to the Congress. They included the elimination of two species of tsetse fly from 7,000 square miles of country, by the application of aerosol from fixed-wing aircraft and helicopters. With that method there was every reason to anticipate that before the end of the coming summer the tsetse fly would be eradicated from South Africa and also the disease nagana in its epizootic form. They also had experience of dipping in South Africa, which had gone on for many years.

Speaking in regard to South African conditions, the advent of the new synthetic insecticides was the beginning of the loss of control of ticks. That might appear to be something of a sweeping statement, and it was not meant to imply that the synthetic insecticides were not fully effective when properly used in a proper and effective concentration; they were fully effective, far more effective than was generally appreciated.

In experimental work they had been compared with a standard dip method in which anisate of soda was used in a concentration of 1:6 at seven-day intervals. It was found that the control animals not treated became so heavily tick infested in a few weeks that the ticks were hanging on like bunches of grapes and the animals had to be dipped so that they might be saved from the irritation, and possibly anaemia caused by the teeming millions of ticks. Whereas, when synthetic insecticides were used there was soon control, so that the control animals did not show any infestation at all. It could therefore be concluded that here was a weapon which, if properly applied, could be used to control and possibly eliminate the tick from a given area.

The great difficulty was that of practical application. In South Africa, in the control areas, not only the farmers but also the natives and traders were so accustomed to seven-day dipping—and at certain times of the year there was five-day dipping—that if the dip was not insisted upon people would think there had been a revolution!

In those areas the use of synthetic insecticides was not allowed, simply because of the difficulty of application. Unless one ensured that there was a chemical analysis of the dipping wash not less than once a month it was not possible to maintain the tank at the requisite strength. There would be LOBE—loss of biological efficiency. They did not know what that really was and it might as well be called "individual idiosyncrasy." When a method involved a 4,000-gallon tank, which had to be emptied and cleaned and filled with water, which was scarce, and replenished with a proper concentration of insecticide, it became a matter which was not practical. Therefore, in South Africa, they were rather "sold" to the use of sprays.

Therefore, in this connection, it had been thought on theoretical grounds that the matter would be one of great simplicity: one had so many animals to dip and therefore made up the requisite amount of dip wash, knowing that it took three-eighths of a gallon to wet an average-sized beast. But when controlled experiments were run on a large scale there were difficulties again, difficulties which were not unsurmountable but which indicated that a great deal of research would have to be done before spray dip could be properly used.

On one occasion he and his colleagues had been using BHC at a concentration of 20 parts to a million. The wash was made up accurately, agitated in the sump, pumped for not less than 10 minutes and a sample was taken; 300 head of cattle were then put through it without agitation of the sump, in the full belief that in the volume of water being pumped out there would be an adequate agitation of the powder. After the animals had been passed through, a second sample was immediately taken. There was a further thorough agitation by means of hand-agitators and another 300 animals were passed through, with agitation at the sump all the time. A third sample was taken. The concentration in the first sample was exactly 20 parts to the million; in the second sample the concentration dropped to 12 parts to the million, which looked like a preferential removal of the insecticide from the spray wash. That, however, was not borne out by the fact that the concentration of the third sample was 19·8 parts to the million.

He could not agree more with the opinion that if they were going to apply this wonderful weapon to the control of ticks they must in the first instance have an improvement in the formulation of the various insecticides. The commercial firms must come to their assistance so that there was uniformity of formulations.

Would the authors of this most valuable paper they were considering give some idea of what they thought should be the specifications for an effective spray? It was stipulated that there must be not fewer than 36 nozzles, not less than 6,000 gallons of fluid should be passed an hour, the nozzle pressure must be not less than 18 and not more than 30 lb. a square inch. But even those stipulations were quite unsatisfactory. It was found that if one used a nozzle pressure as high as 40 lb. a square inch there was a very much better wetting than in cases where it was not permissible to use a pressure greater than 22 lb. a square inch because of atomisation.

There remained an enormous amount of work to be done and it was of very great value to them all to pool their knowledge.

He wanted to use this opportunity to express his very sincere appreciation to the commercial firms for the way they had come forward with all the information they had gained and made it available. That action had been completely mutual and it was a very great step forward.

With regard to the control of sheep parasites, South Africa had no scab, except when there was an invasion from time to time from neighbours; 2,000,000 sheep migrated every year from the Union into Swaziland, and when some animals returned they were found to be infected with scab. It was simply controlled because an adequate use of BHC was something in the nature of the answer to a maiden's prayer.

There was, however, another difficulty. With the use of BHC there was a considerable incidence of lumpy wool. It would be appreciated that if in a flock of 3,000 or 4,000 there were up to 800 suffering from lumpy wool it was a ghastly mess and a considerable economic loss. It could be overcome by the addition of copper sulphate to the wash, but the staining of wool had to be considered in regard to the lower market values. With the use of BHC, if

there was not lumpy wool there was that "white hardness," which was certainly a factor when it came to selling.

He wanted to repeat that when it came to the control of ectoparasites in sheep there remained a considerable amount of work to be done, and anything they could find which was going to improve their method of application and would lead to standard and uniform formulations could be only to the good.

Had the authors of the paper any evidence to show that any tick had developed a resistance to DDT? The BHC resistance had developed very rapidly indeed, he said, although he did not want to go into criticism of the method that developed resistance or the question of why in a part of South Africa the arsenic-resistance tick had developed.

The CHAIRMAN: They must now have a contribution from home, where the practitioners no doubt had many problems. He had in mind, for example, difficulties which arose over the export of cattle to Canada and other countries, where mange was a notifiable disease. Certain exporting herds were infested and it was most difficult to clear the condition up. It would be most interesting to hear their experiences in these herds. The small-animal practitioners must have their problems too, and he hoped would make a contribution.

Professor W. L. WEIPERS (Glasgow): Both the paper and the discussion had been extremely interesting. It was a great pity that more practitioners were not coming forward to discuss this matter. He himself had not a great deal of claim to being a practitioner nowadays, but had been one for a long period.

There was one question he wished to put to Mr. Harbour, a question which might have been put by anybody practising in the north-west and west of Scotland, especially in the highland area. There was a great deal of trouble there with louping-ill in cattle. Practitioners in that area quite often asked what was the best and most simple and practical method they could advise their clients to use to minimise the risk of louping-ill infection. He was not referring to a question of complete eradication. So often crofters in that area, with no opportunity of having elaborate apparatus, would lose one or two cattle in a year. Occasionally the disease occurred in horses.

Mr. Brander had made the point that eradication of ticks should be tackled by the Ministry. Professor Weipers was a little disturbed about that, not purely from the point of view of the development of resistance in the tick, but from the effect on tick-borne diseases. Perhaps the authors had had some experience of an area where partial eradication had been carried out but had been effective only over a period of two or three years. He was thinking particularly of cases of tick-borne fever in relation to the development of acclimatisation acquired with the usual methods of husbandry. Might that not be a serious matter?

There was one small-animal question he had relating to cats and dogs. The parasite with almost prescience had developed a biological relationship which greatly assisted survival. The intervention of a satisfactory barrier of ear wax prevented close contact between the parasite and acarides. He had been disappointed so often in this connection; at first one got very good results in treating a case—one apparently got the animal right but after three or four months the condition reappeared as bad as before. His own view was that one had to remove the wax mechanically to permit the dressing getting at that particular area. Perhaps these parasites were not only located in the ears and there might be something comparable to changing sites in sheep scab, the parasites occasionally moving to other parts of the body.

The RECORDING SECRETARY then read the following written observations from Mr. J. S. STEWARD (Nottingham): I would like to congratulate the essayists on their thorough review of the subject and would apologise for my remarks being contributed in my absence.

A most important aspect of chemotherapy (including insecticidal) which is usually neglected is the study of the effect of the other constituents of the pharmaceutical formulation on the active principle. Thus, for example, with anthelmintics a fully active dose can be rendered quite inactive by incorporation in an unsuitable vehicle, *e.g.*, tetrachlorethylene in oil (mineral, animal or vegetable); ref. Steward, *Acta. pharmacologica* (Copenhagen) about 1947. Phenothiazine can be rendered inactive in the same way, but its anthelmintic activity can also be increased four to eight times by formulation in a suitable base (unpublished data, Steward).

With gammexane, washes prepared from oily emulsions and solutions *appear* more effective than particulate dispersions in the treatment of parasitic mange. I do not possess experimental data on this point but rely here on clinical observations. In other words, alteration in the formulation or physical preparation of an active compound may profoundly alter its effectiveness.

I am APPALLED when I hear that pharmaceutical firms make marked alterations in the formulation of their products, *e.g.*, penicillin, without providing evidence *in the appropriate animals* that the persistence of therapeutic blood levels has not been reduced. *Caveat emptor*—let the buyer beware. For use in veterinary practice I look for no more effective insecticide than gammexane though I do not generally inflict on my clients the extra expense of the ultra purified formulations.

The resistance of *Boophilus* (the blue tick) to gammexane was no doubt induced by the over-optimistic application of only marginally effective dosages—a mistake to be avoided in the use of modern therapeutic drugs in general.

The Reply

Mr. H. E. HARBOUR, in reply: Mr. Montgomery, in his very able opening of the discussion, had remarked that in Australia difficulty had been found in applying results got in maggot fly control in the field. The authors of the paper had not intended to convey that field trials were useless; far from it. They thought that the proper procedure was the careful sifting of all the concentrations or insecticides by the artificial method, followed up by a very large-scale field trial. One of the difficulties of field trials in the past was that an attempt was made to get evidence from perhaps two or three farms, whereas 50 to 100 farms or flocks were needed to supply the necessary evidence.

Mr. Montgomery had mentioned that dipping had some disadvantages when sheep were in long wool, and had then gone on to speak of spraying. In Australia, surely spraying was usually done with animals with very short wool, and perhaps in those circumstances dipping had not got the disadvantages referred to.

It was interesting to hear that scab was eradicated by nicotine dips in Australia, continued Mr. Harbour, because he was under the impression that the butcher's knife and the humane killer had been used and that they were even more effective than the nicotine dip.

Mr. Montgomery had mentioned larvae picked up three days after dipping in 0·5 per cent. p.p. DDT. That was contrary to the published work of a number of Australians who had recorded quite long periods of protection from the picking up of the larval *Boophilus* following the use of DDT. It was admitted that the original choice of a low concentration, only 0·005 per cent. of gamma BHC, had been largely responsible for the rapid development of BHC resistance in the blue tick in South Africa. When higher concentrations were regularly used there had been very little evidence that a resistant strain had been established. It was admitted also that the best way to formulate these new insecticides was not known, but very considerable progress had been made, particularly in relation to the formulation of one of the newer insecticides, namely, toxaphene. There was a lot of work to be done and a lot was being done.

It was sometimes forgotten by research workers who were not connected with the commercial application, that when one tried out a new insecticide and its application for the treatment of a disease one must think not only of the efficiency of that particular formulation and of its stability in the dipping bath and spray plant, but also of the stability in the tin on the store shelf. It was of no use producing marvellous formulations if, in fact, they went to some up-country store where the ingredients settled down at the bottom into a hard clay and a chisel had to be used to get them out.

In one very interesting section of Mr. Montgomery's address he referred to resistance and put forward the idea that what was wanted was an insecticide of the highest killing properties but not with the longest killing potential. The idea seemed to be that one should kill everything on the animal at the time but not allow the insecticide to go off gradually and thus expose new ticks to sub-level concentrations. Was that not asking for the moon?

Boophilus was the only tick they knew that had become resistant to insecticides and it was one particularly suited to do so because it was a one-host tick and it lived on one animal in all its stages of larva, nymph and adult, and it was only the egg stage which was found on the ground.

There was great difficulty in killing the moulting nymph and one must have an insecticide either capable of completely destroying all the moulting nymphs or one that would stay on the animal long enough to kill the adults as they emerged. They knew of no insecticide which was so potent that it would completely clear the animal of all the moulting-nymph stages of *Boophilus*, without exerting some residual effect.

Mr. Johnstone, speaking of blowfly control, had referred to the use of concentrations lower than those used in Australia and had postulated the possibility of resistance developing. Mr. Harbour said that although the future might prove him to be wrong, he did not think that there was very much fear of resistance developing in the case of this parasite. There was no evidence that it had occurred already and one must remember that a very large proportion of the *Lucilia sericata* population never visited sheep at all; they were quite content with carrion in which they could breed. Quite apart from that, the only evidence of resistance to ectoparasites was that of resistance in the case of the one-host *Boophilus* tick. Also, that had occurred only in countries where

dipping had been carried on throughout the year at weekly or fortnightly intervals, *i.e.*, 52 or perhaps 26 treatments a year, but certainly not only two or three, which was the maximum expected for the maggot fly. Therefore, development of resistance of *Lucilia sericata* was rather unlikely, at any rate for a very considerable time.

Mr. Brander had already answered Mr. Spence's point about sarcoptic mange. A great deal more work on that disease was necessary. One would like to hear that some research worker was settling down to deal with the life history (which had not been worked out) of the sarcoptic mange mite in cattle.

Mr. Spence had come back from Australia very much impressed with the wonderful new bland dressings which were applied to sheep for the control of maggot fly. It might, however, be suggested that the old types of barbarous caustic dressings were on their way out before he had got in the aeroplane that took him to Australia. There had been for many years development in this country on bland dressings of the type referred to, and one should not think that this country had been in any way behind Australia in that particular development.

Reference had been made to the possibility of heavy dew predisposing to fly attack in New Zealand. Several things were needed for the occurrence of fly strike. First of all, it was necessary to have conditions under which the fly could fly about, ready to lay eggs, and sunshine and warmth, and not too much wind, were desirable. Secondly, it was necessary for the sheep to be attractive in some way. That might be provided by actual muck on the fleece or the condition of the fleece due to climatic conditions. It might be that heavy dews did produce in the fleece a condition or microclimate necessary to attract the fly.

Dr. Alexander had given a very stimulating speech and had put very clearly a number of very difficult problems. He had made the statement, which sounded very startling, that the advent of new insecticides in South Africa was the beginning of the loss of control of tick, and had gone on to point out that that was because although new insecticides were potent it was difficult to ensure that they were used properly. One must admit that, but while doing so should point out that in South Africa the problem of tick control was very different from that in other parts of the world. There were more kinds of ticks there, which complicated the position. In Jamaica the matter was confined practically to the control of *Boophilus* and one could afford to dip at intervals of a fortnight or, with a sufficiently potent insecticide, even at intervals of four, five or six weeks. In South Africa that was impossible because of the large numbers of other two- and three-host ticks, particularly those capable of transmitting East Coast fever.

As to what specification should be demanded of a spray race, Mr. Harbour said that he could not give the specification required. The spray race was experimental and throughout its use modifications of the nozzle, nozzle pressures, and many other factors, had been going on. That work had, in fact, been continuing for something like three years and a useful working specification had been arrived at, but he could not tell what it was because, quite frankly, he did not know. The evidence obtained so far showed that the spray race that had been developed would give a good biological control of ticks, probably as good or nearly as good as dipping would, but in the case of East Coast fever control it would still be necessary to supplement by the hand-dressing of ears and tail tuft.

It had been said that the use of BHC led to an increase in lumpy wool. Mr. Harbour said he would challenge that statement because, although since BHC had been used all over the world for sheep dips there had been an increase in lumpy wool, he would like to quote the results of a trial a colleague had done in New Zealand. Disturbed by the increase of lumpy wool, this colleague had divided a flock into three parts. One part had been treated with an arsenical dip, the second with BHC, and the third was the control. Lumpy wool had occurred throughout that flock and was just as prevalent in the sheep not treated with BHC. Some South African workers also had produced evidence to confirm the belief that BHC as such was not responsible for the increase in lumpy wool.

One could not simply add copper sulphate at the rate of 1 lb. to 50 gallons to every dipping bath, because of the effect on the wool, and it was necessary for research workers to try to find perhaps some new chemical which would control the fungus associated with lumpy wool disease.

It had been asked if there was any evidence that ticks had formed resistance to DDT. So far as Mr. Harbour knew, the answer was No. Of course, DDT, although it had been used a good deal in Australia and to a fair extent in South Africa, had not had the same volume of usage as had BHC, so time would tell.

In South Africa, the tick which was resistant to BHC was also rather resistant to many insecticides, notably toxaphene and chlordane, but it was not resistant to DDT and so DDT could be used to control the BHC-resistant tick. For how long that state of affairs would go on one did not know.

Professor Weipers had asked what could be suggested to a crofter, for example, to cut down his tick population and minimise the effect of louping-ill in cattle. Mr. Harbour said that his own colleagues had tried to get 100 per cent. control and had found they could get it only by using quite high concentrations of insecticides. They had been able, by weekly treatments, to achieve 100 per cent. control, but the protection obtained was never more than for eight days. It meant that in order to get complete control farmers had to apply the treatment at weekly intervals and in fact that was too expensive.

However, the proportion of ticks infected with louping-ill virus was relatively small, so if one got a fair control and cut down the the number of ticks one would reduce the incidence of louping-ill. It might, therefore, be useful to apply a treatment which was not 100 per cent. but which would substantially cut down the number of ticks involved.

He could quote only one particular experiment in that connection. A farmer in Somerset had been very much troubled by red water. He used a cream containing 2½ per cent. of BHC, which he applied every week to his dairy animals, and from that time had no more cases of red water. That was bad evidence and one would not be particularly impressed by it, but with louping-ill, where the number of ticks was small, there seemed to be a sporting chance that application perhaps at fortnightly intervals might be helpful. It was very easy to apply a thin cream of that sort, provided the animals were easily caught and handled.

With reference to tick-borne diseases, Professor Weipers had brought out questions that could occupy discussion for several hours, the questions of how far one could go with eradication or with control and the possibilities of severe abortion storms occurring because of loss of immunity to tick-borne fever. Mr. Harbour thought that the latter was a very real danger, but only when control got to the point of being nearly complete. As things were at present, tick control in sheep was not sufficiently complete to result in the elimination of the small number of ticks necessary for carrying on the immunisation for tick-borne fever.

Referring to the treatment of otodectic mange, he agreed that it would be necessary to attempt to remove the wax which might act as a barrier to the insecticide reaching all the parasites.

Mr. W. Downing, who was then called upon by the Chairman to address the meeting: Mr. Harbour had stolen most of the thunder and he had only one or two additional remarks to make. Mention had been made of the eradication of tick in Queensland as compared with eradication in the United States. The answer to that was perhaps that when the States had set out to eradicate the tick they did the job thoroughly; 14 days full dipping was rigorously enforced at certain times of the year until an area was cleared. If cattle were not rounded up by the owners, the federal authority did it and charged the owner the cost of the dip and of dipping the cattle. His own feeling was that ticks would never be eradicated unless the job was done thoroughly.

Turning to the question of absorption of BHC, certain experiments had been done by oral administration. His co-workers had tried it for sheep scab control and so had a colleague in the Argentine. They had tried it for the control of lice on guinea-pigs. It could be done, but the curative dose was so close to the toxic dose that, as a method of control of these parasites, it was not very satisfactory.

With regard to sarcoptic mange and several other parasites, one of his colleagues had observed that in the summer lice on cattle sought certain predilected sites. If sufficient work were done it would perhaps be found that parasites such as the sarcoptes of cattle, and possibly the chorioptes, had latent predilection sites and that that might partly account for the difficulty of controlling some of these diseases in the field.

He had observed in the past that dogs which had had sarcoptic mange might appear relatively free of the disease after treatment but careful examination had shown that a few mites had persisted in the double fold at the base of the ear and could remain there for quite a long time.

Another subject referred to had been the comparison of results in different countries. They had found in dealing with scab, keds, sheep ticks and other parasites that there was a very marked difference between the control with a rising or falling population. He, personally, did not carry out any experimental sheep scab dippings in the spring or summer as by that time the parasite population would be on the decline and appeared to be very much more susceptible to insecticides than when in the rising and active stage. That was a point which should be borne in mind when results in different countries were compared.

Mr. I. W. Montgomery: It might be of interest to members to learn that in Australia quite a lot of work had been done on fogging. Application of insecticides by fogging was attractive, particularly in the west country where water was short and where, if this method could be used successfully, it would be most valuable. Using

concentrations of DDT up to 10 per cent., they had not, unfortunately, got the efficiency that would be desired and so at this stage had no reason to recommend this as a treatment to control ectoparasites generally.

He quite agreed with the clinical picture that had been given of blowfly attack in this country and his own country. He did feel, though, that the differences observed were the effect of different types of larvae rather than the reaction of strike on different types of sheep, because with the true English breeds in Australia blowfly strike gave much the same picture as with the merino.

In Australia it was felt that humidity was not necessarily an important factor and strike could occur in dry weather. It appeared that the micro-humidity in the fleece was more important than atmospheric conditions.

Recently he had been investigating nozzles for the application of the newer insecticides in the industrial field, especially in relation to the control of malaria, and an interesting development was that of a carborundum type of nozzle. Quite a degree of corrosion had been found in varying type nozzles after use, especially with dispersible powders which could upset the efficiency of an application. Fan type nozzles of carborundum were apparently having a longer life than the machines themselves and were giving very useful and uniform results.

Lumpy wool in Australia was not usually identified with any particular insecticide. White harshness of wool might be a result of an insecticide usage but could generally be related to the solvent used. The newer insecticides were insoluble and had to be formulated with a variety of agents such as solvents and emulsifiers which might have a marked effect on wool.

In demodectic mange in Australia they had not had quite the results hoped for and on occasions had been able to improve these by the simultaneous use of penicillins. They had also been attempting to give oral dosage but, as had already been said, the effective dose was so close to the toxic dose that it presented a rather difficult problem.

Mr. Harbour's reply had referred to dip *versus* spray. He himself had referred more to the spraying of sheep for protection against blowfly strike when they had not got long wool.

Turning to the nymphal stages of *Boophilus*, he would have to think about that matter before replying. He had not been considering an insecticide the effectiveness of which would cut off immediately after application, but one that would not give residual efficiency lasting over a long period and thus create a possible resistance problem.

He was very pleased that Mr. Downing had raised the question of host/parasite relationship, which was so important to the whole of ectoparasite control. If more was known about what happened to the parasites, their ecology and their predilection sites, it would help workers to go a lot further in devising methods of controlling parasites.

The people in Queensland had never, to his knowledge, attempted an eradication campaign. They were rather worried that they might reach the problem of near eradication and outbreaks of piroplasmosis. In New South Wales there had been, though probably not as effectively as in the U.S.A., a very intense and reasonably well-controlled effort at eradication by dipping with a 14- to 21-day interval. The country was very rough and hilly and mustering and handling consequently difficult and, although there had been successful eradication of cattle tick in the southern portions of the infested area, success had not been achieved in the areas adjoining the Queensland border.

The Chairman: Before thanking the authors, there was one small point to which he wished to reply. Mr. Brander was rather concerned about what would happen in this country when sheep scab was eliminated and the Ministry of Agriculture no longer took any steps to enforce dippings. Sheep scab regulations applied by the Ministry were operating now in only a few counties; most of the remainder of the country was covered by local authority regulations, which required dipping once or twice a year. That was done not so much because of sheep scab as in the interests of good sheep husbandry. Even if scab was got rid of in this country dipping would still continue. Baths continued to be put up or renewed in different parts of the country and people were in some cases receiving financial assistance from the Government for erecting them.

They all wished to thank the authors for their most valuable and excellent paper, which had stimulated a very good discussion. Their thanks were due also to the speakers in the discussion and particularly to Mr. Montgomery. He had given a very interesting talk and they were very much indebted to him. (Applause.)

CLINICAL COMMUNICATION

THEMALON: A NEW CANINE ANALGESIC AND HYPNOTIC

A. F. GREEN,
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The analgesic and hypnotic properties of a series of dithienylallylamines have been described by Adamson and Green (1950) in a preliminary communication, and a full description of their pharmacological properties is in the press (Green, 1953). Many of this group of compounds have shown promise of being valuable analgesic-hypnotic agents for use in dogs, and for a variety of reasons the choice fell on 3-diethylamino-1 : 1-dithienylbut-1-ene hydrochloride, referred to in the following description of its action in the dog, by its trade name, Themalon.

Themalon is a white powder, highly soluble in water. An aqueous solution of the drug may be boiled but will not withstand autoclaving, and develops a brown colour if kept for a few days. Fifty to 200 mg. per 1 ml. in water produces no obvious local reaction when injected subcutaneously; it has in fact a distinct local anaesthetic action. Orally given in gelatine capsules, it acts as a gastric irritant, for it usually causes rejection of the stomach contents. On the other hand, a concentrated solution (200 mg. per ml.) may be instilled into the mouth without causing vomiting, but is mildly resented since it has a bitter taste.

The principal pharmacological effects of Themalon are its analgesic and hypnotic action. In these respects it closely resembles morphine, but there are a number of important differences. Themalon, at the higher dosage levels, produces a degree of insensitivity to pain unobtainable with morphine. Further, it has no tendency to cause vomiting when injected parenterally. Side-actions are mild and occur only in some dogs. They are a dribbling of saliva from the mouth, due in part to a depression of the swallowing reflex, and later some increase in bowel evacuation. The salivation is prevented by atropine (0·05 mg. per kg.).

The potency of Themalon has been estimated in tests in over 70 dogs by clinical observation and measurement of the effects on the pain threshold. As with other analgesics in this class, the degree of effect varies to a large extent with the dose administered and the route chosen, and to a lesser extent with the temperament and proportionate size of the dog. Given subcutaneously, it is about a fifth as active as morphine sulphate and three to four times more active than pethidine on a weight-for-weight basis. Doses between 5 and 20 mg. per kg. give a degree of effect ranging from mild analgesia and sedation, to deep narcosis. The action commences within 5 to 10 minutes, is at its peak within 30 minutes and lasts between 1 and 10 hours depending on the dose and other factors. Small dogs require a larger dose on a weight-for-weight basis than do large animals. The hysterical type of animal is relatively resistant to the drug; as much as 50 mg. per kg. subcutaneously may be necessary to produce deep narcosis. Injected intravenously in doses of 1 to 5 mg. per kg., narcosis is commonly observed within a few minutes, and recovery is much more rapid than with subcutaneous administration, being complete within a period of 15 minutes to 3 hours or more, according to the size of the dose. The intraperitoneal route has been little used. So far the dosage required and times for onset of effect and recovery have been intermediate between those for subcutaneous and intravenous administration.

To determine the toxic effects of Themalon a number of dogs have been injected with doses far in excess of the narcotic level. No undesirable effects were seen until the dose rate

had been increased to 100 mg. per kg. subcutaneously, and 10 mg. per kg. intravenously. The subcutaneous injection of toxic doses produced very early analgesia and hypnosis followed by convulsions which can be controlled by the injection of pentobarbitone sodium. Doses of the order of 10 mg. per kg. injected intravenously cause immediate convulsions and not uncommonly death supervenes.

The toxicological action of Themalon has also been studied in dogs anaesthetised with pentobarbitone sodium. Injected intravenously, the drug causes an immediate fall in blood pressure, brief apnoea and spasm of the small intestine.

The available evidence indicates that Themalon can with advantage replace morphine in canine practice. The onset of analgesia and hypnosis is smooth and recovery is quite uneventful. By adjusting the dosage administered it is possible to choose a level of effect varying between mild sedation to deep narcosis, and by using the alternative routes of administration the desired period of action to some extent may be selected.

Acknowledgment.—The author is indebted to Dr. A. C. White and to his colleagues in the Veterinary Department here, Dr. R. F. Montgomerie and Mr. A. B. MacIntyre, for their co-operation.

References

Adamson, D. W., & Green, A. F. (1950.) *Nature, Lond.* **165.** 122.

Green, A. F. (1953.) *Brit. J. Pharmacol.* In the press.

ABSTRACTS

Vaccination Against Johne's Disease*

The results are described of an experiment to test the efficacy of a vaccine in the protection of sheep against infection with *Myc. paratuberculosis* (Johne's disease). The vaccine was prepared from heat-killed organisms grown in a liquid synthetic medium and suspended in mineral oil. Two hundred and eighty-nine lambs born in 1947, 1948 and 1949 on three farms known to be infected with the disease were vaccinated when six months of age and 266 were kept under the same conditions as controls. The results, assessed in 1951, show that whereas 16 (6 per cent.) of the controls died of paratuberculosis, no deaths from this cause occurred in the controls. From the *post-mortem* examination of 225 vaccinated and 194 control sheep, it was shown that only four (1·8 per cent.) of the former and 21 (10·8 per cent.) of the latter were affected with lesions of the disease. The presence of lesions in two of the vaccinated sheep is explained by the fact that they were probably infected by their dams in early life.

Sigurdsson is of the opinion that the testing of vaccines against this disease is best carried out by means of a field experiment rather than by artificial infection.

S. J. E.

* **Vaccination against Paratuberculosis (Johne's Disease).** Sigurdsson, B. (1952.) *J. Immunol.* **68.** 559.

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Renal Lesions in *L. canicola* Infection in Dogs*

Along with some general clinical and *post-mortem* data, the authors give a fully detailed and well-illustrated composite account of the renal lesions in 34 dogs (none of them over five years of age) which had been definitely shown to be affected with *L. canicola.* Of these dogs, 21 were in the acute stage, and 13 in the subacute or chronic stage. Broadly speaking, the renal lesions were of the types familiar under the names of "acute interstitial" and "chronic interstitial" nephritis. In the acute stage, a marked interstitial infiltration with cells, mainly mononuclears, occurred, particularly in the boundary zone, and it is suggested that this locus of the main cellular infiltration is attributable to the operation of a "renal shunt" mechanism during the stage of leptospiral invasion of the kidney. The intense cortical ischaemia at this stage might explain the severe oliguria and the albuminuria. Leptospirae were not demonstrable in the interstitial cellular exudate, but were readily found in the lumen of the convoluted tubules.

It was possible to trace the disease from the acute to the chronic stage in six dogs, and it seemed that, in young dogs at any rate, a period of about two years probably was required for the full development of granular contracted kidneys. Following on the acute stage, there was post-inflammatory scarring in the boundary zone. Occasionally, organisms were found in tubule lumina in residual foci of acute inflammation. Renal vascular changes due to a slowly increasing hypertension, always associated with left ventricle muscular hypertropy, were observed. Attention was again drawn to the striking hyperplasia of the epithelium of the collecting tubules.

Further details of interest to pathologists will be found in the paper.

E. C.

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Curare in Canine Surgery*

The author sets out to evaluate curare in combination with various anaesthetic agents in veterinary surgery. Four hundred experiments were conducted on dogs, using a solution 1 c.c. of which contained 2 units of curare. It was administered intravenously. The anaesthetic agents used were nembutal, pentothal sodium and ether. As an antidote a 1 : 2,000 prostigmine solution was employed. It was found that $\frac{1}{4}$ unit per lb. bodyweight of curare administered to an unanaesthetised dog had no detectable effect, but $\frac{1}{2}$ unit produced respiratory paralysis in one dog and $\frac{3}{4}$ unit caused marked respiratory depression in several.

Under nembutal light plane anaesthesia ($\frac{3}{4}$ gr. per 5 lb. bodyweight) dogs were suspended at an angle of 45° and were struggling and crying. "Within a few seconds following the injection of $\frac{1}{4}$ unit (per lb. bodyweight) of curare the struggling and crying ceased. The animals hung there more completely relaxed than they would have been had they been given a full surgical dose of nembutal. Sixteen of these dogs, however, did show some degree of pedal reflex." Maximum relaxation varied from 6 to 25 minutes. When a dose of $\frac{3}{8}$ unit per lb. bodyweight was used relaxation lasted from 9 to 30 minutes. It was decided that the dosage rate of $\frac{1}{2}$ unit was dangerous. With nembutal surgical anaesthesia (1 gr. per 5 lb. bodyweight)—there was slight struggling and crying in some of these dogs when suspended—there was little variation in the results from those obtained under light-plane anaesthesia.

It was decided that $\frac{3}{8}$ unit of curare per lb. bodyweight was the most satisfactory dosage in light-plane and surgical anaesthesia produced by either nembutal or pentothal sodium. Not less than two minutes should be taken for the curare injection.

* **Renal Lesions in *Leptospira canicola* Infection in Dogs.** McIntyre, W. I. M., & Montgomery, G. L. (1952.) *J. Path. & Bact.* **64.** 145-160.

* **Curare in Canine Surgery.** Pickett, D. (1951.) *J. Amer. vet. med. Ass.* **119.** 346-352.

Curare in $\frac{1}{8}$ or $\frac{1}{4}$ unit dosage was felt to be contraindicated in either anaesthesia due to the profound depressant action on the respiratory and vascular systems. Its use with atropine is also contraindicated.

The author is of the opinion that the employment of curare cuts down the amount of anaesthetic agent required in surgery and, therefore, diminishes the surgical risk. It has been used in no less than 250 surgical cases with undesirable effects in one case only, and is recommended for caesarean section, metrectomy in cases of pyometra, diaphragmatic hernia, and particularly in the repair of fractures where complete muscular relaxation is so desirable.

C. F.

REVIEW

[**The Extra Pharmacopoeia (Martindale).** 23rd Edition published by *The Pharmaceutical Press*, London (1952). pp. 1,352. 55s.]

There must be many members of the veterinary profession to whom Martindale's Extra Pharmacopoeia was familiar as a book of reference. First published in 1883, the book contained 313 pages ; the 23rd Edition now issued contains 1,352 pages —it would have been even larger but for an increase in the type area of each page. The high standard of the earlier editions has been fully maintained in the present edition under the editorship first of Mr. Denston and latterly of Dr. Capper.

The drugs are dealt with in monographs which, after treating of characters, actions and uses, go on to give brief synopses of published reports of the uses. Altogether there are some 4,000 such references and these are a valuable feature of the book.

As might be expected, there is a long section on antibiotics ; this is most informative and should be as useful to the veterinarian as to the practitioner of human medicine.

There has been some " shift of emphasis in the direction of a pharmacological classification." Since this shift is as yet incomplete, the reader may find the arrangement a little confusing but he is assisted by a very good index. For instance, under " Dicoumarol " are included heparin and other anticoagulants but digitalis and strophanthus are to be found separated according to an alphabetic arrangement.

Perhaps primarily intended for the pharmaceutical chemist, this book must also be a valuable guide to the medical practitioner. To the veterinary surgeon it is a useful book of reference and also a book from which much interesting information can be gleaned.

Incorporated in the Extra Pharmacopoeia is Squire's Extra Pharmacopoeia, a book of reference well known to an older generation of veterinary surgeons. The copyright of both the Extra Pharmacopoeia and Squire's Pharmacopoeia is now the property of the Pharmaceutical Press and this edition of the Extra Pharmacopoeia fully maintains the high standard one has come to expect in the productions of the Pharmaceutical Press.

Weekly Wisdom

Technology is, of course, only a long Greek name for a bag of tools ; and we have to ask ourselves : what are the tools that count in this competition in the use of tools as means to power? All tools are not of the material kind ; there are spiritual tools as well, and these are the most potent that man has made.— Professor Arnold Toynbee : " The World and the West "—No. 1 of the new series of Reith (broadcast) Lectures.

VICTORIA VETERINARY BENEVOLENT FUND

MEETING OF COUNCIL

A meeting of the Council of the Victoria Veterinary Benevolent Fund was held at No. 10, Red Lion Square, London, W.C.1, on Friday, September 26th, 1952, when the following members were present : Professor J. B. Buxton (President) in the chair, Professor T. G. Browne, Mr. H. W. Dawes, Major J. J. Dunlop, Mrs. D. I. Glover, Mrs. C. L. Graham (President, Ladies' Guild), Professors W. M. Mitchell, L. P. Pugh, G. H. Wooldridge. Mr. C. W. Francis, Secretary, was in attendance.

Welcome to New Member.—Before proceeding with the business on the agenda, the President cordially welcomed Mrs. C. L. Graham, newly elected President of the Ladies' Guild, to the meeting.

Minutes.—The minutes of the previous meeting, held on July 1st, 1952, having been printed and circulated, were taken as read and signed as correct.

Apologies for Absence.—Letters of apology for absence were received from Messrs. A. J. Beeson, H. Bell, Professor J. McCunn, Mr. Arnold Spicer and Captain A. Whicher.

Correspondence.—(*a*) The Secretary read a letter from Mrs. D. I. Glover, Hon. Treasurer, enclosing cheques from the Ladies' Guild of £200 and £450, for the Current Relief Account and the Christmas Fund Account respectively. The Secretary was instructed to convey the Council's grateful thanks for these handsome contributions which will be disposed of in accordance with the wishes of the Guild members.

(*b*) A letter from Messrs. Watson, Digby and Pope, Solicitors, enclosing cheque for £100 bequeathed to the Fund by the late Mr. John Hammond, of Fakenham, was read, together with the Secretary's reply.

(*c*) Correspondence was submitted from the executors of the will of the late Mr. G. H. Gibbings, of Tavistock, enclosing cheque for £200 left to the Fund out of the estate. The Secretary stated that he had replied suitably on behalf of the Council.

Treasurer's Report.—The Treasurer reported that, acting on instructions given at the last meeting, he had arranged for the balance of £274 16s. 2d. standing in the Donations Account to be invested in the purchase of £372 7s. 10d. 3½ per cent. War Loan.

The Treasurer stated, further, that he had accepted the offer from the Savings Bank Division for our holding of £350 in 3 per cent. Defence Bonds (Third Issue), shortly due to be redeemed, to be reinvested in 3½ per cent. Defence Bonds (Conversion) Issue.

It was resolved " That the action of the Treasurer be approved."

Accountant's Report

The following report of the Accountant was received and adopted :—

Since the previous quarterly meeting the following legacies, special subscription and donations have been received :—

	£	s.	d.
Legacies			
Estate of John Hammond, M.R.C.V.S.	100	0	0
Estate of G. H. Gibbings, M.R.C.V.S.	200	0	0
Subscription			
Ladies' Guild (special)	200	0	0
Donations			
Collecting Boxes	£ s. d.		
Central Veterinary Society ...	1 13 6		
Scottish Branch, B.V.A. ...	1 11 9		
	3	5	3

	£	s.	d.	£	s.	d.
"*In Memory of Mr. F. H. Stainton*"						
Miss M. M. Chatterton ...		5	0			
R. A. Willett	2	2	0			
				2	7	0
Mrs. S. M. S. Bowditch (Alsatian Club Show)				1	11	6
Eastern Counties Veterinary Society (Shipley Bowls Tournament)				6	10	0
J. B. Edwards (Wellingborough and District Canine Society)				2	2	0
Royal (Dick) School of Veterinary Studies Students' Representative Council—Annual Ball				13	13	5
R.S.P.C.A., Southampton Branch				12	10	0
Royal Veterinary College—Graduation Dinner Surplus				1	11	6
A. Seligman (per A. Whicher)					10	0
Society of Practising Veterinary Surgeons ...				20	0	0
Sutton, E. G., and Cook, E. R. (British Timken Show)				1	1	0
R. A. Willett (Windsor Championship Show)				5	5	0
R. N. Wood (S.V.R.)					6	0
"A. W."					10	0
				£571	2	8

Christmas Fund Account				
Ladies' Guild	£450	0	0	

Hunting Trust.—The Secretary reported that in his capacity as Secretary to the Trustees of the Hunting Fund he had pleasure in announcing for the information of Council that under a New Deed of Appointment dated September 15th, 1952, the surviving trustees had appointed Messrs. John Neish Ritchie and George Newman Gould to fill the vacancies caused by the deaths of Lieut.-Colonels J. W. Brittlebank and P. J. Simpson.

Cases

No. 264. Widow ; aged 70. One daughter, aged 35, who has been ill for the past two years. At the last meeting this case was referred to the Executive Committee, who decided to increase the grant from £4 6s. 8d. to £6 10s. after reviewing the application in the light of subsequent information which had been obtained.

No. 285. Widow ; aged 78. Husband died on June 5th, 1952. Two sons and three daughters. Receiving 18s. per week as rent of three cottages and £1 5s. allowance from two sons. This case having been referred to the Executive Committee by the Council at its last meeting, with power to act, a grant of £1 10s. per week was made to this applicant.

It was resolved "That the action of the Executive Committee in the above cases be confirmed."

No. 286. M.R.C.V.S. ; aged 73. Illness prevents him from practising ; receiving £2 2s. per week in respect of his wife and himself from the National Assistance Board. Wife also in receipt of £74 per annum from legacy. Living in own house. The Executive Committee reported that in view of the request by the applicant for urgent assistance they had carefully examined the case but decided that it should be referred to the Council for consideration. An immediate special grant of £10 was given by the Committee pending the Council's decision.

It was resolved : (*a*) "That the action of the Executive Committee in giving an immediate grant of £10 be approved"; (*b*) "That the case be again referred to the Executive Committee with power to make a further grant after the Secretary had obtained certain information from the National Assistance Board in regard to this application."

No. 287. M.R.C.V.S. ; aged 36. Married. Met with motor accident and badly fractured leg in 1950. After two years was able to walk again but slipped and broke leg again three weeks ago. Will now be incapacitated for 6 to 12 months. No means and dependent on widowed mother. After careful consideration of this case it was decided that a member of the Fund be asked to interview the applicant and that his report be submitted to the Executive Committee, who shall be empowered to take such action thereon as may be deemed desirable.

No. 288. Widow ; aged 71. Husband, served in R.A.V.C., retired, died July 23rd, 1952. No income. Special grant of £100 given by R.A.V.C. Benevolent Fund. Case now passed to this Fund.

It was resolved : "That a temporary grant of £1 10s. per week be made in this case pending the result of her application to the War Office for a compassionate pension."

No. 253. Daughter of late member ; aged 53. The Secretary reported that it had come to his notice that in the near future this applicant would benefit to the extent of £50 a year, left to her by her sister. It was decided that having regard to her financial position, which will improve under her late sister's will, this applicant be informed that the grant from the Fund will be discontinued as at the end of the present year.

Date of Next Meeting.—It was resolved "That the next meeting of Council, to be held in the month of February, 1953, be left in the hands of the President and the Secretary to arrange.

QUESTIONS IN PARLIAMENT

Slaughterhouses

Mr. G. Williams (November 26th) asked the Minister of Food when the Committee appointed to investigate conditions in slaughterhouses is likely to report.

Major Lloyd George: As the Committee has only just started its enquiries, I cannot say.

Mr. Williams: Would it not be a good thing for the Minister to give them some guidance as to when they should get their task completed, because much anxiety is felt by many people interested in this subject?

Major Lloyd George: It is an extremely important matter into which they are enquiring, and it is bound to take a little time. I would remind my hon. Friend that the last report took about eight months, but I will certainly get in touch with them.

. . . . .

Foot-and-Mouth Disease Notices

Mr. G. Williams (November 27th) asked the Minister of Agriculture if he will take steps, through the agricultural executive committees, to encourage taking down notices prohibiting the public from agricultural land owing to foot-and-mouth disease, as soon as the ban on the movement of cattle is lifted.

Sir T. Dugdale: My veterinary staff are responsible for the removal of all notices put up by order of the Ministry. As regards notices put up by farmers, I am asking local authorities and my veterinary staff, who are responsible for operating the foot-and-mouth disease regulations, to do what they can to encourage the removal of these notices when the need for them has passed.

Mr. Williams: Thank you very much.

Memorial to the late Harry Steele-Bodger

The British Veterinary Association has inaugurated a fund to endow a memorial to the late Harry Steele-Bodger, President during the years 1939–46, and Chairman of the Survey Committee 1939–46. The Memorial will take the form of a Travelling Scholarship for Veterinary Surgeons.

It is hoped that all members of the profession will give their generous support in memory of one who, with his colleagues, did so much to further the aims and aspirations of the veterinary profession and to extend veterinary practice in its widest sense to each and every farm in the country.

The fund is open to all—both within and without the profession—who would wish to pay tribute to the late Harry Steele-Bodger's work for the profession, for agriculture and for the country.

His colleagues within the profession will be aware of the tremendous effect of the war-time endeavours which he so ably and so tirelessly led.

Those in agriculture will be aware of the lasting benefit of that closer association with the profession forged by those endeavours and of the benefits which have accrued.

Organisations, societies, business interests and individuals outside the profession who may wish to lend their support will be welcomed as subscribers to the memorial.

The members of the Appeal Committee are :—

The Officers of the Association :—
Mr. A. M. Graham, President,
Mr. A. J. Wright, Senior Vice-President,
Mr. A. Thomson, Junior Vice-President,
Mr. H. E. Bywater, Hon. Treasurer, B.V.A.,
Mr. H. F. Hebeler, Hon. Secretary, B.V.A.,
Mr. F. Knight, General Secretary, B.V.A.,

Mr. G. N. Gould, Chairman,
Dr. R. Lovell, Vice-Chairman,
Mr. S. L. Hignett, Hon. Treasurer,
Mr. R. F. Armour,
Mr. E. P. Barrett,
Mr. J. A. Brown,
Professor T. G. Browne,
Dr. H. G. Lamont,
Dr. R. F. Montgomerie,
Miss Rosa Smith, Hon. Secretary,

together with some other veterinary surgeons, known to the above Executive Committee as friends of the late Harry Steele-Bodger, who have been invited to join the Committee.

All donations should be sent to the Hon. Treasurer of the Appeal Committee :—

S. L. Hignett,
Steele-Bodger Memorial Fund,
British Veterinary Association,
36, Gordon Square,
London, W.C.1,

and cheques, postal orders, etc., should be made payable to the "Steele-Bodger Memorial Fund."

The first list of subscribers will be published in the December 20th issue of *The Veterinary Record*, and supplementary lists will be inserted from time to time.

NOTES AND NEWS

Diary of Events

Dec. 9th.—Technical Development Committee, B.V.A. (to discuss Sheep Diseases Report), 11 a.m.
Dec. 10th.—Technical Development Committee, B.V.A. (Ordinary Meeting), 10 a.m.
Dec. 10th.—Meeting of the Editorial Executive, B.V.A., 2.30 p.m.
Dec. 10th.—Annual General Meeting of the Scottish Branch, B.V.A., in the Royal (Dick) School of Veterinary Studies, Edinburgh, 2.30 p.m.
Dec. 10th.—Annual General Meeting of the Farmers' Club, Royal Empire Society Hall, Craven Street, London, 2.15 p.m. (Mr. Geo. N. Gould, M.R.C.V.S.: Problems of Animal Health Associated with Grassland and the Feeding of Fodder Crops.)
Dec. 10th.—Meeting of the Southern Counties Division, B.V.A., at Winchester (Royal Hotel), 6.30 p.m.
Dec. 10th.—Meeting of the South-East Midlands Division, B.V.A., at Northampton, 2.30 p.m.
Dec. 12th.—Winter General Meeting of the North of England Division, B.V.A., at Durham (Waterloo Hotel), 6 p.m.
Dec. 12th.—Meeting of the South Wales Division, B.V.A., at Cardiff (Park Hotel), 2 p.m.
Dec. 12th.—Meeting of the Midland Counties Division, B.V.A., at the Birmingham Medical Institute, 2 p.m.
Dec. 12th.—Annual Dinner and Dance, North Wales Division, B.V.A., at Llandudno. (See Notice.)
Dec. 17th.—Meeting of the Section of Comparative Medicine, Royal Society of Medicine, at 1, Wimpole Street, W.1., 5 p.m.
Dec. 19th.—Meeting of the Sussex Division, B.V.A., at Brighton (The Old Ship Hotel), 2.30 p.m.
Jan. 2nd.—Meeting of the Association of Veterinary Teachers and Research Workers, at the Royal Veterinary College, N.W.1, 11 a.m.
Jan. 9th, 1953.—Dumfries and Galloway Division, B.V.A., Ladies' Guild: Annual Dance in aid of the V.V.B.F., at Dumfries (Cairndale Hotel). (See Notice.)
Feb. 27th.—Annual Ball of the Veterinary Society, Faculty of Veterinary Science, The University, Liverpool, to be held in the Students' Union from 8.0 p.m. to 2.0 a.m.

R.C.V.S. Examinations

Membership Examinations.—Orals and Practicals: Commencing Monday, December 8th, 1952.

Council and Committee Meetings of the B.V.A.

The following arrangements for the Council and Committee meetings of the B.V.A. in January, April and July of 1953, have been made by Council B.V.A.:—

January 14th, 15th and 16th in London.
April 29th, 30th and May 1st in Edinburgh.
July 29th, 30th and 31st in London.

The times of the various meetings will be published in due course.

The next quarterly meetings will be held in London on January 14th, 15th and 16th, 1953, in the following order:—

Wednesday, January 14th.—11 a.m., Home Appointments Committee; 12 noon, Parliamentary and Public Relations Committee; 2.30 p.m., Organising Committee.

Thursday, January 15th.—10 a.m., Veterinary State Medicine Committee; 12 noon, Finance Sub-committee; 2.30 p.m., General Purposes and Finance Committee.

Friday, January 16th.—11 a.m., Council Meeting.

R.C.V.S. Council and Committee Meetings

The next series of meetings will be held in London on February 4th, 5th and 6th (Council).

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Jury Service

We are asked to give final intimation that the electoral rolls are now being compiled and will be published shortly, the names of persons liable to serve as jurors being marked on such lists with the letter **J**. Any person on the Register of Veterinary Surgeons or the Supplementary Veterinary Register will be liable for jury service, unless he or she takes the necessary steps to observe the law. Exemption is not given automatically by the Veterinary Surgeons Act, 1948, and it is necessary for the person concerned to make certain each year that the jury mark has not been placed against his or her name in the electoral register.

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R.C.V.S. WAR MEMORIAL

In connection with the preliminary notice of arrangements for the unveiling of the War Memorial, which appeared in the issue for November 1st, 1952, the Registrar of the R.C.V.S. has been unable to trace the names and addresses of next of kin of the members whose names appear below:—

V. R. Bhardwaj
A. M. Fyfe
D. H. Greeves
K. G. Comrie
A. C. Jonas
C. P. Chaudhri
A. M. Howie
P. H. J. Keast
K. D. McDougall

If any reader has information concerning relatives of these members will he kindly communicate with the Registrar, R.C.V.S., 9, Red Lion Square, London, W.C.1., in order that they may be informed of arrangements for the ceremony.

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PERSONAL

Births.—Goodhand.—On November 21st, 1952, to Peggie (*née* Richards), wife of R. H. Goodhand, B.Sc., M.R.C.V.S., a son—Keith.

Mackinnon.—On November 2nd, 1952, at Portwey Hospital, Weymouth, to Janet (Roderick), wife of William Mackinnon, M.R.C.V.S., Woodpeckers, Beaminster, Dorset, a son—Ewen Lachlan.

Penhale.—On November 4th, 1952, to Pamela (*née* Chittenden) and Allin Penhale, M.S.R.C.V.S., at Horizon View, Stratton, Cornwall, a daughter—Hilary Janet.

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Ministry's Veterinary Field Staff: Changes in Personnel.—The following changes are announced:—

Mr. A. Kelly, B.Sc., M.R.C.V.S., D.V.S.M., at present Veterinary Officer at Retford, has been promoted to Divisional Veterinary Officer and was transferred to head office on December 1st, 1952.

Mr. J. A. McGranaghan, M.R.C.V.S., has been appointed to the permanent staff as Veterinary Officer and will be stationed at Chichester as from December 1st, 1952.

Mr. E. A. Stewart, M.R.C.V.S., has been appointed to the permanent staff as Veterinary Officer and will be stationed at Norwich as from December 1st, 1952.

Mr. P. H. de Gruchy, M.R.C.V.S., Veterinary Officer, Weybridge, has been transferred to the Ministry's Veterinary Investigation Service.

For the further information of our readers, intimation is made that the Ministry's Divisional Office in the North Riding has been moved to Government Buildings, Crosby Road, Northallerton, and the Divisional Office at Oxford to Government Buildings, 2 (Corridor A), Marston Road, New Marston, Oxford.

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Mr. N. R. Reid's Appointment with FAO.—Mr. Niel Richard Reid, M.B.E., B.V.Sc. (S.A.), M.R.C.V.S., has retired from the post of Director of Veterinary Services, Tanganyika Territory, preparatory to taking up an appointment with the Food and Agriculture Organisation of the United Nations.

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R.C.V.S. OBITUARY

Motton, Samuel John, F.R.C.V.S., Captain late R.A.V.C., of Rosevean, Penzance. Graduated London, July 29th, 1908; Fellowship January 31st, 1914. Died November 30th, 1952.

Death of Captain S. J. Motton, F.R.C.V.S.

We record above with deep regret the death of Captain S. J. Motton, F.R.C.V.S., one of the best-known practitioners in the West of England, who rendered sterling service also in the corporate life of the profession through his able Hon. Secretaryship of the Western Counties Division and thus as a member of the Council of the British Veterinary Association for many years. He was also, for a considerable period, a valued member of Council, R.C.V.S.

Pending the publication of a fuller notice, we reproduce the following message received on Monday last from Miss E. R Parker, Mr. H. J. D. Neil and Mr. B. C. M. Edmonds, M.R.C.V.S.:—

"The death of Mr. S. J. Motton, which occurred in his sleep in the early hours of Sunday, November 30th, will come as a shock to his many friends in the profession.

"There can have been few in the world with as wide a knowledge of his profession. Whatever the animal he could always give you the information you wanted or tell you where to find it.

"We, his partners, feel that we have lost not only a partner but a real friend—and one to whom we could turn at any time for help and advice."

Sympathy with the widow will be widespread, for over a very long period Mr. and Mrs. Motton have been a familiar and well-loved pair at the annual congresses of the Association.

A TRIBUTE

With the passing of Mr. S. J. Motton the veterinary profession has lost one of its most valued members and the West of England an outstanding personality, one whose name was known to all lovers of animals throughout the area. In addition all have lost a charming man, who with that characteristic cheery smile and witty remark helped along the toil of the day.

He was a great clinician and his powers of observation together with his ready facility for the methodical memorising of data made him the obvious reference for all his colleagues in times of doubt. He was never known to have refused assistance and in every problem, whether great or small, the trouble he took to help those in any difficulty was a pattern of that solid perseverance in following up references which we could all emulate to advantage. Besides the long hours which he devoted to his practice at Penzance he always found the time every day to make an improvement in the knowledge of his art by diligent reading of the literature even when this involved him in reading well into the early morning following a hard day's work.

For more years than many of us wish to remember he was the very efficient Secretary of the Western Counties Division of the B.V.A. and from the time of his appointment in the 1920s he had never missed a single meeting. When one remembers the extensive area covered by this division and the fact that there are four meetings a year involving in all cases a minimum travelling of over 200 miles, this was an incredible performance and again reminds us of his enthusiasm for his profession.

He also found time for many years to act as an Examiner for the Royal College and later sat on the Council of that body for some time. Recently he had once more joined the examining panel, and I know that this work gave him considerable pleasure.

Perhaps to many he will be remembered best by the services he rendered on the Council of the B.V.A. Rarely was his face missing from these deliberations and at the annual conferences it might be said that the conference and Jack Motton were synonymous terms. It has been very many years since he missed one and not only did he throw his energies wholeheartedly into the serious side but he was always well in the fore at the evening sessions with that smile and joke which made him so popular. He was looking forward with high hopes to the time that the conference would once more come back to the Western Counties area.

I have been privileged to know him for many years, perhaps more intimately than many. It was in the practice in which he was then a partner at Penzance that I became his assistant nearly 30 years ago and ever since then there has been a firm bond of friendship between us; this I always greatly treasured and I had looked forward to its continuing for many years to come. He started me in my professional career, as he did many who followed me, with all that help, kindness and guidance which was so natural to his nature and thus laid the foundations of a structure which I trust was worthy of all the labours he expended on me.

Jack Motton departed this life in harness as he would have wished, but his name and worth to the profession will remain as a monument for all to see from generation to generation. May we all benefit by his exertions.

L. E. P.

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A memorial service at Gulval Church, near Penzance, on Friday, December 5th, at 2.30 p.m., was conducted by the Vicar, Canon Buckley. The President and Council of the Royal College of Veterinary Surgeons were represented by Mr. A. R. Smythe, of Falmouth, and the British Veterinary Association by Mr. L. E. Perkins, of Truro.

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William Rutherford Wallace

An Appreciation

William Rutherford Wallace, whose death was recorded in your issue of November 22nd, was born in Aberdeen in 1896 and received his schooling in that town. He entered the Royal (Dick) Veterinary College soon after the first world war and qualified in July 1921 after an excellent academic career, during which he collected many College prizes and medals. After several years in general practice he entered the Malayan Veterinary Service in 1927 and spent most of his service until the Japanese war as a field officer in the States of Selangor and Perak where he frequently gave indication of his high professional competence and interest, particularly in the investigation of livestock and poultry diseases. In 1937 he gained the Edinburgh Diploma in Tropical Veterinary Medicine. He married in Australia in 1940.

At the fall of Malaya to the Japanese army in December, 1941, he suffered three and a half years' internment in the civil prison camps at Changi Gaol and Scine Road, a factor which may well have contributed to his death. He returned to Malaya in 1946 after a few months' recuperation and was appointed Director of Veterinary Services, in which post he applied himself unsparingly to the many unusual and arduous rehabilitation problems of the post-war period. He retired in 1950 to Australia where he acquired a property near Sydney and took up cattle rearing.

Bill Wallace was an unassuming personality, quiet almost to the point of shyness, but with great strength of character, who made a deep impression on his colleagues and staff by his wide and detailed professional knowledge, his justness as an administrator, and his utter conscientiousness and devotion to his work. The news of his death at the relatively early age of 56 came as a sudden and sad shock to his friends, who extend to his widow their sincere condolences and sympathy, and their deepest regrets that, after 23 years' splendid service in Malaya, he was spared so little time in well-earned retirement.

W. E. L.

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INTERNATIONAL VETERINARY CONFERENCE IN VIENNA

Diseases Common to Man and Animals

On November 25th there opened in Vienna an international conference to consider five diseases that are naturally transmissible between vertebrate animals and man. The conference was held under the joint auspices of the World Health Organisation and the Food and Agriculture Organisation and was attended by representatives of some 20 countries including Dr. A. W. Stableforth, of the Ministry of Agriculture and Fisheries veterinary laboratory, Weybridge; Sir Thomas Dalling, formerly Chief Veterinary Officer in the Ministry of Agriculture and Fisheries, and now with the FAO in Rome; and Mr. J. N. Ritchie, Chief Veterinary Officer of the Ministry of Agriculture.

The diseases chosen for consideration were rabies, bovine tuberculosis, brucellosis, leptospirosis, and "Q" fever.

The aim of the conference was to achieve a combined medical-veterinary approach to the problem of controlling these diseases which can be applied on an international scale. Besides the group discussions the delegates took part in practical laboratory demonstrations organised by the Austrian authorities, who acted as hosts.

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EUROPEAN FOOT-AND-MOUTH DISEASE COMMISSION

In the course of a recent Press release FAO states that foot-and-mouth disease has cost Europe approximately 600 000,000 dollars in the past 18 months. To protect governments against such staggering losses, FAO is suggesting a kind of insurance scheme which will cost each country only one half of one American cent a year per head of livestock. A meeting was held at FAO headquarters in Rome on December 1st and 2nd to discuss this and other methods for the control of foot-and-mouth disease through the establishment of a co-ordinating European Foot-and-Mouth Commission.

Foot-and-mouth disease in livestock kills only a small percentage of its victims—the proportion varies from two to five per cent.—but it takes 12 months to get an animal back into shape after an attack and during all this time the farmer must feed it. Cows frequently give no milk for an entire lactation period. They often lose their calves, which sometimes results in skipping whole lactation periods. Meanwhile, these useless beasts cannot be sold, unless at a great loss, because the disease has reduced their value. This is where the financial losses arise: they are losses in animal products, rather than losses in animals.

"Quarantine and sanitary measures can partially check the spread of foot-and-mouth disease. A policy of slaughter of all infected and exposed animals usually results in rapid eradication, but this is too expensive a method for many countries. The other control method is vaccination, but production of vaccine is also expensive. Furthermore, although the virus from which the vaccine is produced can be stored indefinitely, vaccine loses its protective power and supplies must be constantly renewed. FAO is advocating that stores of the three types of foot-and-mouth virus be maintained in all countries which are able to manufacture vaccine. The virus can be kept indefinitely and these stores would form a permanent reserve for rapid vaccine production to meet outbreaks. As for the vaccines, FAO advocates that sufficient quantities of internationally available

stores be held in one or more countries to meet the threat of an outbreak in any country of Western Europe. Individual countries would then have to manufacture vaccines only during actual outbreaks, for the international stocks would tide them over the first three weeks before they could use vaccine of their own manufacture produced from the stored virus.

"It is obvious that this kind of mutual insurance system would lower considerably the defence cost for single participating countries.

"When the Sixteenth Session of the Council of FAO met in Rome recently it had before it a resolution proposing that the Council recommend to member governments adoption of the plan of concerted national and international action outlined above.

"Meanwhile, such a plan has already been endorsed by representatives of the Governments of Denmark, Finland, France, Greece, Ireland, Italy, Luxembourg, Netherlands, Norway, Sweden, Switzerland, United Kingdom and West Germany at an FAO meeting on the Control of Foot-and-Mouth Disease in Europe held in Copenhagen on September 17th to 19th. Representatives at that meeting further decided that the best way to stimulate and co-ordinate national and international control measures would be through a European Foot-and-Mouth Disease Commission.

"Of the proposed Commission Dr. Keseven, Chief of FAO's Animal Production Branch, says: 'We have been getting together mainly at the International Office of Epizootics to discuss the techniques and measures to control the disease, but what we need is a joint action programme so that everyone might help no matter where it breaks out.' The Commission would be exactly such a joint action organisation.

"If the Commission is established as a result of the December 1st and 2nd meeting in Rome it will work through a secretariat provided by FAO to: maintain a register of stocks of vaccine and virus in different countries and facilitate joint arrangements for joint action on storage and production; help make supplies of vaccine and virus available in emergency outbreak areas; study the possibility of establishing an international laboratory to deal with typing of strains of virus and production of vaccine; and carry on a number of research and other functions necessary if the disease is to be completely stamped out of Europe. The technical advice for this work will be given by the group of veterinarians who met at the International Office of Epizootics."

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UNIVERSITY OF LONDON B.Sc. (VETERINARY SCIENCE)

Following is the Pass List for the October, 1952, University of London B.Sc. (Veterinary Science) Examination: Laing, William I'Anson Peter; Payne, Jack Marsh; Shipley, William; Wiltshire, Leslie Vasey; and Wood, Keith Halsted Benjamin—all internal students of the Royal Veterinary College.

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B.V.A. CONGRESS INVITATION

Local papers report that at its last meeting Bristol Health Committee decided to ask the Lord Mayor and Sheriff's Committee to issue a firm invitation for the British Veterinary Association annual congress to meet in Bristol in 1956.

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ADDRESSES OF DISEASE-INFECTED PREMISES

The list given below indicates, first, the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

ANTHRAX:

Berks.—Northfield Farm, Kingston Bagpuize, Abingdon (Nov. 22nd); The Chestnuts, 149, Nine Mile Ride, Wokingham (Nov. 24th); New Hayward Bottom, Hungerford; Foxhold, Crookham Common, Newbury (Nov. 25th).

Bucks.—Eaton Ley Farm, Water Eaton, Bletchley (Nov. 25th).

Cardigans.—Parc-y-Pratt Farm, Cardigan (Nov. 21st).

Ches.—Blakelow House, Newcastle Road, Wybunbury, Nantwich (Nov. 21st).

Derbys.—Poplar Farm, The Green, Hardstoft, Pilsey, Chesterfield (Nov. 25th); Bailey Slatts Farm, Green Fairfield, Buxton; Scarcliffe Grange Farm, Chesterfield (Nov. 27th).

Devons.—East Cleave Farm, Sourton, Okehampton (Nov. 21st); Colliepriest House Farm, Tiverton (Nov. 22nd); Hemsford Farm, Littlehempston, Totnes (Nov. 26th).

Dorset.—Afflington Farm, Corfe Castle, Wareham (Nov. 24th); Birch Tree Cottage, Potterne Road, Three Legged Cross, Wimborne (Nov. 26th).

Durham.—Lingey Steel, Copley, Bishop Auckland (Nov. 24th).

Essex.—Balk Farm, Great Waltham, Chelmsford (Nov. 21st).

Hants.—77, Poplar Cottages, Little Aum, Andover (Nov. 25th); Rosedale, Alresford Road, Winchester (Nov. 26th).

Herefords.—Lane End House, Pontshill, Ross-on-Wye (Nov. 21st); Wandon Green Farm, Luton, Beds.; Queens Wood, Cradley (Nov. 24th).

Herts.—Amwell Farm, Amwell, Wheathampstead, St. Albans (Nov 26th).

Isle of Wight.—Worsley Dairy, Worsley Road, Newport (Nov. 22nd).

Kircudbrights.—Greenslack Farm, Gatehouse-of-Fleet, Castle Douglas (Nov. 26th).

Lancs.—Old Hall Farm, Pleasington, Blackburn (Nov. 26th).

Oxon.—12, Drayton St. Leonard (Nov. 27th); Old Manor Farm, Bix (Nov. 28th).

Somerset.—Callows Farm, Buckland St. Mary, Chard (Nov. 22nd); "Foresters," Clapton-in-Gordano, Bristol (Nov. 24th); Charity Farm, Upton, Long Sutton, Taunton (Nov. 26th); Stoke Hill Farm, Stoke St. Mary, Taunton (Nov. 26th).

Staffs.—Bleak House Farm, Knightley, Woodseaves (Nov. 24th).

Stirling.—Easter Blairskaith Farm, Torrance, Baldernock, near Glasgow (Nov. 25th).

Suffolk.—Lodge Farm, Mendesham, Stowmarket (Nov. 24th); Yew Tree Farm, Weybread, Harleston (Nov. 26th).

Sussex.—Sunnybank, West End Lane, Henfield (Nov. 21st).

Westmorland.—Crook Hall, Crook, Kendal (Nov. 24th).

Wilts.—Mill Farm, Broughton Gifford, Melksham (Nov. 21st); Bacon Factory, Calne (Nov. 22nd); New Forest Dairy Farm, Woodfalls, Redlynch, Salisbury (Nov. 26th).

Yorks.—Whaw Farm, Arkengarthdale, Richmond (Nov. 24th); Farnley Hall Farm, Farnley, Leeds; Church House Farm, Danby; Knowle Garth Farm, Heyshaw, Summerbridge, Harrogate; Cliffe House Farm, Fellbeck, Pateley Bridge, Harrogate, (Nov. 26th).

FOWL PEST:

Cambs.—Hertfield House, 31, The Avenue, March (Nov. 21st).

Essex.—Alton Park Allotments, Clacton-on-Sea (Nov. 26th).

Glam.—West Cliffe, Western Road, Pontardawe, Swansea (Nov. 26th).

Middlesex.—Harefield Hospital, Uxbridge (Nov. 24th); Mount Pleasant Allotments, Harefield, Uxbridge (Nov. 27th).

Lancs.—Greenbank, Over Wyresdale, Lancaster (Nov. 26th).

Lincs.—St. Gerrards, Colton Street, Brigg (Nov. 27th).

Surrey.—Holland Cottage, Blindley Heath, Lingfield (Nov. 22nd); Barncourt Farm, New Chapel, Holland Cottage, Blindley Heath, Lingfield (Nov. 22nd).

Wilts.—Elm Tree Farm, Chippenham (Nov. 24th).

SWINE FEVER:

Ayrs.—Crofthead Farm, Darvel (Nov. 27th).

Berks.—Old Oak Farm, East Hampstead Park, Wokingham (Nov. 28th).

Cambs.—81, West End, March (Nov. 25th).

Ches.—Yew Tree Farm, Hazel Grove, Stockport (Nov. 24th).

Essex.—Ivy Cottage, Great Henney, Sudbury (Nov. 21st); Clicketts Farm, Gestingthorpe, Castle Hedingham (Nov. 26th).

Lincs (Lindsey).—70, Ayscough Street, Grimsby (Nov. 29th).

Staffs.—34, George Street, Smethwick (Nov. 24th).

Stirlings.—No. 15 Holding, Auchenreoch, Milton of Camprie, Glasgow (Nov. 27th).

Sussex.—Hillside Road Piggeries, Hastings (Nov. 24th).

Warwicks.—181, St. Bernards Road, Olton, Birmingham (Nov. 25th).

Worcs.—Holding, off Station Road, Salford Priors, Evesham (Nov 24th).

Yorks (E.R.).—Southfield Farm, Preston, Hull, Yorks (Nov. 29th).

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HUMANE DESTRUCTION OF DOGS AND CATS

STUNNING BY ELECTRIC CURRENT ADVOCATED

In its issue of December 29th *The Times* observed: "Dr. Phyllis Croft, Research Fellow of the Universities Federation for Animal Welfare, who investigated the method of stunning pigs by electric shock before slaughter, is about to complete further research into the humane destruction of dogs and cats. A number of animal welfare societies and agencies, but not all, use death by electric shock in the 'lethal chamber,' particularly where the number of unwanted animals is large. The usual method is to apply the shock through the heart—from neck to feet in the dog, and from forefeet to hindfeet in the cat.

"Dr. Croft, speaking at the federation's annual meeting in London last night, said that ever though the current was sufficiently strong to cause death by heart failure—a current too weak would cause death by asphyxiation—it was now shown that consciousness in cats might persist for 12 seconds after the heart had stopped, and she presumed this applied to dogs also. Human beings who suffered from ailments causing the heart to stop beating had been able to count up to 15, in acute discomfort, after the heart stopped and

before losing consciousness. Dr. Croft advocated passing the current through the brain of the animal and stunning it—a method used in the electro-convulsant treatment of human beings."

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HUMANE DESTRUCTION OF RABBITS: SAWYER TRAP TESTED

Details of tests of the humane rabbit traps designed by Mr. F. E. Sawyer, Netheravon, Salisbury, were released by the Ministry recently. In these tests, the Ministry state, the new trap was equal to the gin trap in catching efficiency and greatly superior to it in the avoidance of suffering. In the course of four major trials, in which 935 rabbits were taken under varying conditions, adjustments in design and better handling with practice gave progressive improvement in results. Rabbits dead on trap inspection rose from 91 per cent. to 99 per cent. and catches by head, neck and shoulder (chiefly neck) from 78·2 per cent. to 100 per cent. In the first test comparative observations were made, and it was noted that only 4·3 per cent. in the new traps were by leg catches against 99 per cent. leg catches in the gins.

To avoid confusion with any other inventions by him, Mr. Sawyer has designated this particular trap the "Imbra" (Patent No. 682427). The trap is compact, easily portable and compares favourably with the gin in the amount of work entailed in setting in the burrow. The trap will now be tried out under everyday conditions by C.A.E.C.s.

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LEGAL NOTES

Unlawful Practice: R.C.V.S. Secures Another Conviction

At Bognor Regis on November 20th, John Douglas Jarvis, of Yeoman's Acre, Aldwick, who pleaded guilty to seven summonses for practising as a veterinary surgeon when not registered, was fined a total of £7 and ordered to pay £3 3s. costs.

Five summonses concerned the treatment of two dogs owned by James Austin Clarke, of Bognor Regis, another related to the treatment of a dog owned by Edgar Albert Lewis, of Craigwell, and the seventh to the treatment of a dog owned by Daisy Louise Dunkin, of Pagham.

Mr. H. Spurgeon, prosecuting for the Royal College of Veterinary Surgeons, stressed that the purpose of the Veterinary Surgeons Act was not for the protection of the veterinary surgeons' profession but primarily for the protection of animals and the public.

Jarvis, it was stated, charged 7s. 6d. for some visits and 10s. 6d. for another.

Mr. Spurgeon said that Jarvis made an application for registration as a veterinary practitioner but made no appeal against the refusal decision. It was quite clear that he knew he had no right to practise.

Jarvis told the court that there were certain things that he was allowed to do after he had made his unsuccessful application and he endeavoured to perform only the duties which he was permitted to do under the Act. He said that the Act had taken away his livelihood.

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THE CONSUMPTION AND PRODUCTION OF MILK

Although milk production in 16 of the world's leading dairy countries is 10 per cent. above pre-war, population has risen 14 per cent. and the development of production in many countries is slowing down or even going back, according to the FAO Committee on Commodity Problems.

The Committee, which has just ended its twentieth session in Rome, attributed the decrease partly to labour and other difficulties in production, and partly to the greater profitability of meat production. The Committee pointed out, however, that the *per capita* consumption of liquid milk has remained constant in the countries which were the largest milk drinkers before the war and has risen in most other countries, though latterly the rate increase has tended to slow down. The increase of 13,000,000 tons over pre-war production of 136,000,000 tons has gone entirely into the consumption of liquid milk. The Committee also added that in countries outside the survey "it is highly probable that production has lagged behind the growth of population." The Committee outlined two main problems: 1, How far can more of the milk now produced be utilised for human consumption? 2, How can milk production be increased and its further consumption stimulated?

It pointed out that if milk producers were to produce more milk for human consumption instead of feeding it to animals they would raise their returns especially from milk used for butter. As the cow is the most efficient converter of plant products into animal protein the Committee felt that greater milk production for human use would help raise nutritional standards. A major problem in increasing the supply of milk is that milk production involves a seven day week which is no longer attractive and in consequence many producers are turning to grazing. The Committee stressed the need to examine the best means of utilising skim milk, dried skim milk, butter, etc., as well as the possibilities of further developing the market for skim milk products especially in the less developed countries which are deficient in animal protein.

The Committee also emphasised the importance of better distribution and marketing methods in order to provide a readily available supply of good quality milk at the lowest possible cost.

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SIR THOMAS DALLING IN ISRAEL

Mr. C. Aharoni, M.R.C.V.S., writes from the District Veterinary Office, Hadera, on November 16th: "When two weeks ago Sir Thomas, on behalf of FAO, was the guest of the Ministry of Agriculture in order to assist in some milk problems, Israeli veterinarians were privileged to meet their distinguished colleague and to listen to a splendid address which touched upon many of the present-day international veterinary affairs. The Chairman of the Israeli Veterinary Medical Association, Mr. Y. S. Goor, introduced Professor Dalling to an audience of over 60 veterinarians, giving a short summary of the speaker's many scientific achievements and his distinguished professional career.

"In his address Sir Thomas dealt with the control of foot-and-mouth disease, tuberculosis, rinderpest, Newcastle disease and the various problems of infertility, trace elements, etc. Again and again he stressed the need for international collaboration and the necessity to create international authorities to fight successfully those panzootics which do not stop at the country's borders. Sir Thomas ended his address with references to the need for a new approach to the problem of veterinary education.

The discussion was opened by Professor A. Jepsen, of Denmark, who—also on behalf of FAO—is spending a year in Israel in order to advise on modern methods of inspection of food of animal origin. Professor Jepsen discussed some of Denmark's successful methods in eradicating bovine tuberculosis.

"Despite his short stay in this country, Sir Thomas had an opportunity of seeing something of the modern farming in Israel.

"The good wishes of the Israeli Veterinary Medical Association were sent through Sir Thomas to the British Veterinary Association."

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INTER-AMERICAN MEETING ON LIVESTOCK PRODUCTION

Discussions on the critical problems hindering the development of the livestock industry in the Americas as well as the new scientific developments having a bearing on their solution will take place at the Inter-American Meeting on Livestock Production to be held in the city of Bauru, State of Sao Paulo, Brazil, from December 8th to 19th, 1952.

This meeting, which was organised by the Food and Agriculture Organisation of the United Nations with the co-operation of the Organisation of American States, will acquaint the participants with the latest developments in each country represented, in the field of animal breeding and nutrition, animal health and the more efficient use of forage crops, cultivated pasture and natural grasslands. During the meeting the delegates will also be informed of the new scientific developments in livestock industry since the first Inter-American Meeting on Livestock Production, convened jointly by FAO and the Inter-American Institute of Agricultural Sciences held in Turrialba, Costa Rica, October 9th to 20th, 1950.

Norris E. Dodd, FAO's Director General, has sent invitations to the following governments to send representatives: Argentina, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, France, Guatemala, Haiti, Honduras, Mexico, Netherlands, Nicaragua, Panama, Paraguay, Peru, United Kingdom, United States, Uruguay, Venezuela.

FAO will provide a group of experts composed of A. T. Semple, Sir Thomas Dalling, Dr. Ralph W. Phillips and Dr. S. W. Work, of FAO's Agricultural Division; Dr. Douglas H. K. Lee, of Johns Hopkins University, and Dr. Orlando Olcese, of the National Agricultural College of La Molina, Peru.

A. T. Semple, author of "Improving the World's Grasslands," one of FAO's best sellers, will be the meeting's consultant in pasture and range lands. On his return to Rome after the meeting, Mr. Semple will visit Surinam, British Guiana and possibly Dakar, to inspect developments accomplished in grasslands in these regions.

The agenda of the Inter-American Livestock Meeting includes such items of interest as animal breeding, physiology in relation to climate, improvement through feeding and management, improving productivity of pasture and range lands; animal diseases and parasites; inspection of meats and foods of animal origin; co-ordination of national programmes in breeding, feeding and parasites and disease control; and livestock credit.

XUM

A Reuter message from Copenhagen says farmers in Southern Denmark are looking for bulls which do not transmit a dislike of mechanical milking to their calves. Many cows refuse to be milked by machinery, and breeding experts say the dislike is hereditary.—*Farmer & Stockbreeder.*

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CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

FEEDING OF ANTIBIOTICS TO FATTENING PIGS

Sir,—In your issue of November 1st, 1952, Worden and Bunyan gave a preliminary account of experiments on the value of feeding of procaine penicillin to fattening pigs. Your readers may be interested in the preliminary findings of experiments carried out at the request of the Agricultural Research Council.

In view of the marked differences in response as reported in the literature to the feeding of antibiotics under different conditions, a large-scale co-operative experiment was arranged on the value of feeding procaine penicillin and aureomycin to fattening pigs; this involved some 400 pigs at five centres.

Those taking part in the experiment have agreed to hold up the publication of their individual results until the whole experiment is completed and the results statistically analysed. They have been the more willing to do so since antibiotics cannot be made available for the routine feeding of pigs until the provisions of the Penicillin Act have been amended, and hence the findings cannot be immediately applied.

It is possible, however, on the basis of the results so far received and analysed, to give an indication of the form which the final results will take.

The experiments were designed to cover as wide a variety of feeding practices as possible. In some of the experiments the basic diet has been an all-meal ration and in others use has been made of the Lehmann system, in which a limited meal ration is supplemented by bulky foods (such as potatoes, fodder, beet, etc.). At each of the centres taking part in the Council's series of experiments, whether an all-meal ration or the Lehmann system is used, two antibiotics—penicillin and aureomycin—are being tested and the effect is being studied of adding each of them to a basic diet consisting of purely vegetable ingredients and to a similar diet containing a percentage (varying from 2½ per cent. to 10 per cent.) of animal protein in the form of fish meal. The pigs after weaning have generally been divided into six groups (each consisting of six or eight animals of similar weight, age and sex) and the experimental treatment of the different groups has been as follows:—

(1) Normal meal ration containing a percentage of fish meal.
(2) Meal ration containing only vegetable protein.
(3) Diet as (1) with penicillin added.
(4) Diet as (1) with aureomycin added.
(5) Diet as (2) with penicillin added.
(6) Diet as (2) with aureomycin added.

Arrangements are also being made to have the carcases of a sufficient number of the pigs carefully examined to ensure that the use of the antibiotic has not led to any deterioration in quality. These examinations have not yet been completed.

The results so far obtained indicate that the addition of either antibiotic to a diet containing fish meal will, under the conditions of these experiments, bring about a reduction (of the order of 10 per cent.) in the time taken to reach bacon weight, and that there is also some improvement (of the order of 5 per cent.) in the efficiency of food conversion, *i.e.*, there is a reduction of about 5 per cent. in the amount of food consumed per pound of liveweight gain. More marked responses have been observed on pigs fed on a purely vegetable diet.

The Council has also arranged for experiments on the feeding of "runt" pigs. The results of these experiments are not yet ready for publication, but it is interesting to note that whilst one experiment gave results very similar to those obtained by Worden and Bunyan, another showed no response whatever. Great care, therefore, must be exercised in drawing any general conclusions from effects observed on individual farms.

The results of the co-operative work on fattening pigs, which it is hoped to publish early in 1953, will include experiments carried out at the Agricultural Research Council Field Station, Compton; the National Institute for Research in Dairying, Shinfield; and two of the Experimental Husbandry Farms of the Ministry of Agriculture and Fisheries. In addition, the Council has available to them data from experiments carried out at other centres.—Yours faithfully, W. K. Slater, *Secretary*, Agricultural Research Council, Cunard Building, 15, Regent Street, London, S.W.1. *December 2nd*, 1952.

PARALYSIS IN SIAMESE CATS

Sir,—I noted with interest Miss Pamela Reynolds' communication in *The Veterinary Record* entitled "Paralysis in Siamese Cats."

I have seen no similar cases in this country, but in recent practice in Southern Natal on at least six occasions I was called to attend cases of paralysis in Siamese kittens. In nearly every case the "paralysis" was due to a fracture of one or more limbs, usually the posterior ones, and involving the femora or humeri. Recovery was remarkably speedy, the animals being on their feet in about 10 days and walking soundly within a month. The site of the fractures was usually mid-shaft, and in no case were the epiphyses involved. None of the cats was adult and although two cases were from the same litter other kittens in the litter were unaffected.

The trauma precipitating the fractures appeared to be of a constantly trivial nature, the usual exertions of a kitten playing being sufficient to cause them. One case, that of a fractured pelvis caused by falling out of a tree as a kitten, and unseen by me at the time, gave rise to dystokia later in life due to incompletely absorbed callus. The callus formation in the femoral fractures was always extensive at first, but resolved fairly quickly. In another case, that of a bilateral femoral fracture, the patient fell off a low chair and also fractured its right humerus. It recovered perfectly, however. No macroscopic bone changes could be seen in one case that died later of feline enteritis, and the X-ray plates in the last bilateral case showed nothing abnormal in the other limbs or unaffected portion of the femora.

These cats were fed on a diet undreamed of by cats in the U.K., living on raw steak in almost unlimited quantities, supplemented by fish or eggs. Appetite was never affected, but in the more or less immobilised cases there was a tendency to constipation and rectal impaction due to the fact that being extraordinarily clean in habit, they would never defaecate unless supported over their usual sand tray.

It would be interesting to know if this bone "fragility" has been met with in the breed elsewhere, to what it could be ascribed and in any case, if the experience of practitioners can justify the commonly expressed opinion that the Siamese is a particularly "delicate" breed of cat.—Yours faithfully, P. N. Humphreys, "St. Enodoc," Glasllwch Lane, Newport, Mon. *November 29th*, 1952.

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BUDGERIGAR'S ORBITAL GROWTHS

Sir,—Can any member give me any information regarding warty growths which have developed during the last two months close to the eyes of an 18-month-old budgerigar? They are about the size of a grain of wheat and are symmetrically placed, one below each eye; they appear to cause the bird some annoyance.—Yours faithfully, John Storey, Lansdown Mews, Lansdown Road, Bath. *November 24th*, 1952.

DISEASES OF ANIMALS ACT, 1950—GREAT BRITAIN

Summary of Returns of Confirmed Outbreaks of Scheduled (Notifiable) Diseases

Period	Anthrax	Foot-and-mouth	Fowl Pest	Parasitic Mange	Sheep Scab	Swine Fever
16th to 31st October, 1952	104	—	19	—	—	20
Corresponding period in—						
1951	7	—	43	—	—	97
1950	12	—	4	—	2	82
1949	18	—	55	—	—	—
1st Jan. to 31st October, 1952	842	494	199	—	1	743
Corresponding period in—						
1951	339	28	653	—	5	1,122
1950	297	20	107	—	23	242
1949	195	13	510	—	34	5

Tuberculosis (Attested Herds) Schemes

The number of Attested Herds, *i.e.*, herds officially certified as free from Tuberculosis as at October 31st, 1952, was as follows:—

England	Wales	Scotland	Total (Great Britain)
45 133	25,542	22,159	92,834